FAMOUS
RUSSIAN
AIRCRAFT

MIKOYAN MiG-21

YEFIM GORDON
AND
KEITH DEXTER
WITH
DMITRIY KOMISSAROV

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Introduction

Aircraft and people both have a fate, happy or otherwise. An aircraft is born under a lucky star when it is created at the right time, when it is mass-produced and needed both at home and abroad. Setting world records is also a measure of a happy fate, but an aircraft can be considered especially lucky when it sets records in terms of production figures.

The Mikoyan/Gurevich MiG-21 is one of the most successful tactical fighters developed in the Soviet Union. The aircraft was built in a multitude of versions, forming the backbone of the fighter fleet of nearly 50 nations for many years. Apart from the MiG-21's Chinese derivatives, the fighter had a production run of more than 12,000; more than 5,000 copies were exported. In some nations the MiG-21 remains in service to this day.

Yet the MiG-21's long life was far from cloudless as far as both the development history and the combat career are concerned.

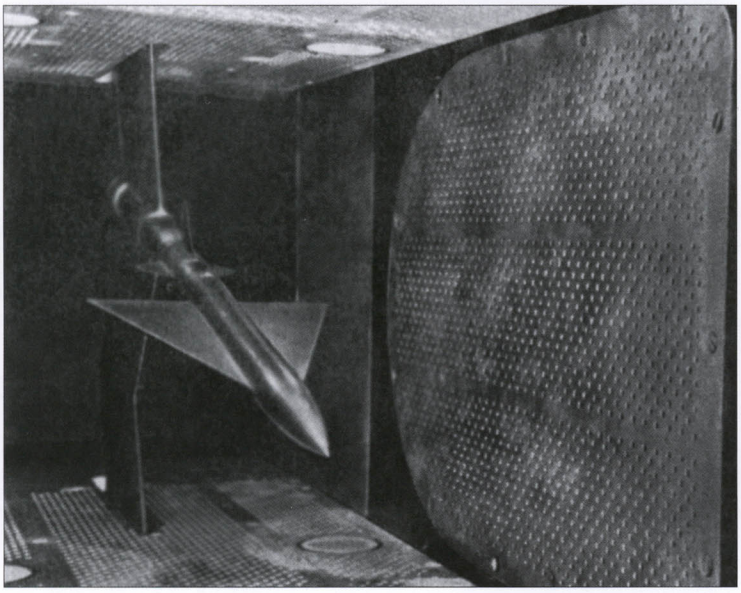
Jet fighter development in the Soviet Union began immediately after the Second World War, and the initial straight-wing designs were quickly superseded by fighters with swept wings. However, these aircraft had wings with 35° sweepback, which allowed them to approach the speed of sound (albeit successfully) but not to exceed it. Furthermore, when the OKB-155 design bureau headed by Artyom Ivanovich Mikoyan and Mikhail Iosifovich Gurevich brought out its first swept-wing fighter, the I-310 (which became famous as the MiG-15; NATO reporting name *Fagot*), several new and unpleasant phenomena came to light. One of these was a tendency to drop a wing (that is, roll uncommandedly) at high speeds, called *val'**ozh**ka* in Russian; it was caused by aerodynamic imperfections (due to insufficiently high manufacturing standards) and by the wings' aeroelasticity (resulting from the wings' insufficient torsional stiffness). The *val'ozhka* was especially pronounced at the fighter's maximum speed (Mach 0.92-0.93) when aileron authority was reduced, complicating roll control. (OKB = ***op**ytno-kon**strook**torskoye byu**ro*** – experimental design bureau; the number is a code allocated for security reasons.)

Furthermore, as progressively more powerful jet engines were developed, the problem of breaking the sound barrier arose. This required additional research in the field of supersonic flight aerodynamics. The task of emulating a supersonic airflow in a wind tunnel turned out to be a highly complex one. Within 12 months the Central Aero- & Hydrodynamics Research Institute named after Nikolay Ye. Zhukovskiy (TsAGI – *Tsen**trahl**'nyy **a**ero-i **ghid**rodina**mi**cheskiy insti**toot***) designed and built the T-112 intermittent wind tunnel with a throat measuring 0.6 x 0.6 m (1 ft 11⅝ in x 1 ft 11⅝ in). As early as 1947 the institute undertook the first wind tunnel tests at speeds equivalent to Mach 0.8-1.7 in the T-112. TsAGI's aerodynamicists established that increasing the wing sweep to 45° made it possible to exceed Mach 1 safely without incurring excessive wave drag; the best results, however, were obtained with wings swept back 55°.

With TsAGI's assistance, in 1948-1950 the Soviet design bureaux brought out a number of fighter prototypes with wings swept back 45°. One of these, the La-176 developed by OKB-301 under Semyon A. Lavochkin, became the first Soviet fighter to crack Mach 1 in a shallow dive in January 1949.

After extensive wind tunnel research and careful analysis of all associated stability and structural strength issues, in 1949-1950 TsAGI worked out a set of recommendations. Taking these into account, the Mikoyan OKB created the SM-2 – the first Soviet true supersonic fighter (known in production form as the MiG-19; NATO

Yefim Gordon archive



▲ **A very provisional model featuring a tailed-delta layout in TsAGI's T-112 supersonic wind tunnel.**

reporting name *Farmer*), which attained Mach 1.35 in level flight. Yet, new problems cropped up as the MiG-19 was being designed. Firstly, at supersonic speeds the need arose to slow down the airflow in the engines' inlet ducts to subsonic speed with minimum losses, as jet engines cannot run in a supersonic airflow. Hence the designers and scientists teamed up to develop a special air intake design for supersonic aircraft. Secondly, the sharply swept wings (the MiG-19's wing sweep was 55°) made it harder to retain adequate lateral stability at high angles of attack (AoAs). Given the technology of the day, for flight safety reasons it was necessary to make the aircraft statically stable in the longitudinal control channel throughout the speed envelope. Research undertaken by TsAGI showed that this could only be attained by carefully choosing the position of the horizontal tail with respect to the wings and placing it close to the wing plane. Another major problem lay in the dramatic reduction of elevator authority at supersonic speeds; this prompted a switch from traditional stabilisers with inset elevators to all-movable stabilisers (stabilators).

The introduction of afterburning turbojet engines made it possible to attain fairly high supersonic speeds. By then TsAGI had amassed the research results necessary to attain such speeds in practice. The first issue that had to be resolved was the choice of wing type. Sharply swept wings (55-60°) were the most advanced type at the time; research revealed that such wings could have a fairly high thickness/chord ratio and a fairly high aspect ratio, providing adequate strength and stiffness. Unswept wings optimised for supersonic flight were required to have a sharp leading edge, which was detrimental to the aircraft's agility; TsAGI deemed this type of wings unsuitable for tactical aircraft. In the opinion of TsAGI's experts, the development and mass production of the Lockheed F-104 Starfighter designed by Clarence 'Kelly' Johnson and featuring unswept low aspect ratio wings was a big blunder – a view substantiated by the F-104's high accident rate.

The renowned Soviet aerodynamicist Pyotr P. Krasil'shchikov, who worked at TsAGI, conducted detailed research of delta wings with different degrees of leading-edge sweep. Theoretical research indicated that the wing leading edge had to be subsonic in order to reduce the wave drag and obtain acceptable aerodynamic parameters in general. To this end, an aircraft designed for a cruising speed of Mach 2.0 had to have 60° leading-edge sweep; this made it possible to use an airfoil with a rounded leading edge and a relatively high thickness/chord ratio (around 5%). Such wings would ensure sufficient manoeuvrability and acceptable performance in take-off and landing modes combined with sufficient structural strength and rigidity. Krasil'shchikov's ideas were well-founded and substantiated by a lot of research; the research on delta wings which his team undertook at TsAGI from 1953 onwards proved extremely fruitful.

Two of the Soviet Union's leading 'fighter makers' – OKB-155 and Pavel O. Sukhoi's OKB-51 – analysed the relative merits and weaknesses of swept and delta wings at great length. Thanks to the research done by TsAGI both options (which were recommended by the institute) were quite practicable; it was up to the aircraft designers to take their pick. Paradoxically, however, the designers could not make the final choice without testing both types of wings in actual flight. Thus, both OKBs decided to build fighter prototypes with swept and delta wings (in other words, differing only in wing type) for comparative tests.

TsAGI's recommendations concerning the fighter's general arrangement, stability, controllability, structural strength and aeroelasticity featured all of the future aircraft's approximate basic dimensions and other data. The institute unambiguously recommended using conventional tail surfaces (in other words, the delta-wing version would be a tailed-delta

aircraft). As a result of the subsequent in-house research and flight tests, the Mikoyan OKB opted for the delta-wing version – a decision that led to the birth of a unique multi-role light fighter with a take-off weight of only 8,000-9,000 kg (17,640-19,840 lb) which is the subject of this book. The Sukhoi OKB, on the other hand, went for both options and put both of them into production but optimised the aircraft for different roles; the delta-wing Su-9 was an interceptor while the swept-wing Su-7 was a tactical fighter-bomber.

Of course, Artyom I. Mikoyan strove to create a fighter which would outclass the French Dassault Mirage tailless-delta fighters and the American F-104. Still, he would not brush Johnson's concept aside without testing it in parallel with his OKB's own design work. As a sideline job, the designers drafted a project of a fighter looking remarkably like the Starfighter, except that it had one nose air intake with a conical centrebody instead of lateral intakes with half-cones. However, wind tunnel research at TsAGI showed that the straight-wing option was no good; the choice made by Mikoyan and Dassault had been correct.

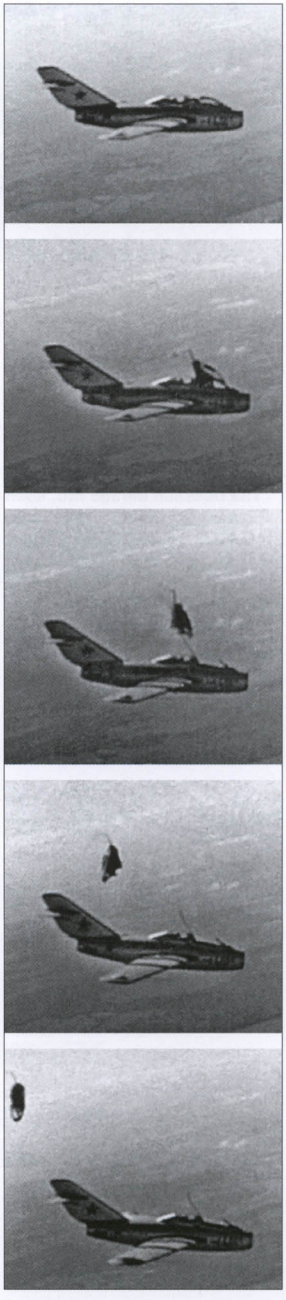
When the Starfighter entered production, such industrially advanced countries as Japan, Italy and West Germany acquired licence manufacturing rights for the type. The F-104 amazed the world with a series of impressive records, but then the tide was turned; Soviet fighters confidently surpassed these records. Besides, the numerous fatal accidents, especially in West Germany, certainly did not add to the Starfighter's popularity. The Vietnam War was the last straw; the F-104 could not wage war on an equal basis with the new MiGs.

However, the choice of wing type was not the only problem facing the designers. As the aerodynamics of the Mach 2+ fighter were developed, the air intake design issue came up again. Once again, TsAGI specialists were called upon to help with the development of a nose air intake featuring a translating conical centrebody (shock cone) whose position was adjusted to suit the flight speed and dynamic pressure.

The development of the Tumanskiy R11-300 afterburning turbojet was another major milestone in the MiG-21's design process. Development of the powerplant was entrusted to OKB-300 headed at that time by Sergey Konstantinovich Tumanskiy, an old friend of Mikoyan, who succeeded the OKB's founder Aleksandr A. Mikulin as Chief Designer when Mikulin fell from favour at the top level. The paths of Mikoyan and Tumanskiy had crossed more than once, starting in the days when Tumanskiy was Mikulin's close aide; Mikoyan's early piston-engined fighters had been powered by Mikulin AM-35 and AM-38 Vee-12 liquid-cooled engines. Later, the MiG-19 was powered by two AM-9 (aka RD-9B) axial-flow afterburning turbojets; the fighter owed its high performance (by the day's standards) largely to this powerplant. However, it was the MiG-21 programme that was characterised by the most fruitful co-operation between the two design bureaux. It was after (and thanks to) the development of this fighter that Chief Designers Mikoyan and Tumanskiy were promoted to General Designers in 1956 (Mikulin had retired from active design work when the MiG-19 was under development). Understandably, Mikoyan wished this co-operation to continue. At a meeting with Tumanskiy he spelled out his requirements for a new engine to power his new fighter. Mikulin was aware that the development of such a powerplant might entail hitherto unseen complications and pitfalls. Yet he supported his airframer colleague fully and took on the task without hesitation – all the more so because an engine meeting Mikoyan's requirements was already on the drawing boards at OKB-300. The biggest challenge was to deliver this engine in time to meet Mikoyan's development schedule.

The designers fully realised that in developing a fighter intended to fly at high Mach numbers, not only structural strength but also the crew rescue system should be accorded the highest priority. Existing ejection seats that were good enough for subsonic speeds could not guarantee pilot survival in the event of an ejection at supersonic speeds. Therefore, taking into account the experience accumulated with the first-generation Soviet ejection seats, the Mikoyan OKB developed a crew rescue system in which the cockpit canopy was to depart together with the seat, protecting the pilot from the slipstream. This system was considered to be sufficiently effective while being simpler and cheaper than a jettisonable crew capsule or cockpit section.

The designers started out by developing a test rig and performing ejections with a dummy at speeds up to 1,000 km/h (621 mph). In the process, special devices stabilising the seat/canopy combination after parting company with the aircraft were designed and tested. A ground rig was used to determine the maximum permissible deceleration G loads for the pilot during an ejection when the pilot was secured by arm and leg restraints and protected from the



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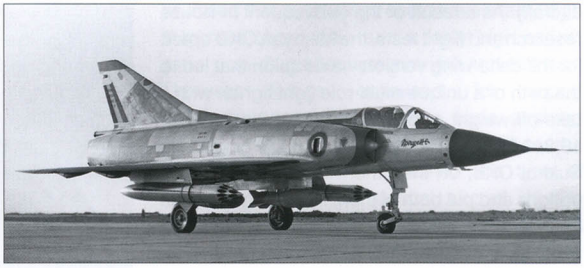
▲
One of the ST-10 ejection seat testbeds, a UTI MiG-15 serialled '401U Blue' (c/n 3401), fires an experimental seat using the canopy as a slipstream protector from the front cockpit.

via RART



via RART

▲ **The Lockheed F-104 Starfighter (represented here by F-104G 60-0739/'FD-739'), had straight wings – a concept rejected bythe Soviet designers of supersonic fighters.**

►▲ **The Dassault Mirage IIIC, seen here in strike configuration, utilised a tailless-delta layout that turned out to be highly successful.**

slipstream by the canopy and a face blind. The efficiency of the protection offered by the canopy was assessed. First, a specially modified Tupolev Tu-2 piston-engined bomber served as an ejection seat testbed; later, the tests continued on a converted UTI MiG-15 *Midget* jet trainer designated *izdeliye* ST-10, the seat being fired from the front cockpit. (*Izdeliye* (product) such-and-such was, and still is, a common way of coding Soviet/Russian military hardware items for security reasons.) Several alternative stabilising systems were tried, including a small drogue parachute at the tip of a four-section telescopic boom extending aft from the seat headrest. The enforced separation of the canopy from the seat after deceleration was verified. Test pilots Eduard V. Yelian and V. Golovin undertook the test programme on one of the ST-10s. As a result, the ejection system making use of the canopy as a windbreak was recommended for fighters capable of speeds in excess of 1,000 km/h.

Artyom I. Mikoyan and his fellow designers were quick to adopt the approach that originated in the Soviet aircraft design school in the late 1950s: the various systems and equipment of a new aircraft were to be tested on the ground before being installed on the actual aircraft. This approach made for higher reliability and flight safety. This job, which called for a lot of enthusiasm, resourcefulness and high engineering culture, was entrusted to A. V. Minayev, who went on to become Deputy Minister of Aircraft Industry. The ground tests did save a lot of time, but still the road from wish to reality in the case of the future MiG-21 was taking longer than expected. As the design effort progressed, the machine became increasingly more complex; this required not only an ever-bigger design staff and the involvement of an ever-increasing number of co-operating design teams but demanded a lot more time, threatening to undermine the future success. Assessing the work done so far by Mikoyan's team as an experienced and well-informed engineer and realising the prospective results of this work, Pyotr V. Dement'yev, who headed the Ministry of Aircraft Industry (MAP – *Mini**ster**stvo aviatsi**on**noy pro**mysh**lennosti*), gave Mikoyan the go-ahead to build a pre-production batch of MiG-21s instead of the customary two or three prototypes.

In developing the MiG-21 the OKB strove to create a fighter that would be both more effective and a lot cheaper than the MiG-19. The growth in combat capability was to be assured by expanding the speed envelope, increasing the rate of climb, acceleration and G limits and improving maintainability. The cost-reduction measures included the switch from twin engines to a single-engine layout, using an engine with a longer service life and reducing the operating costs. The choice of the new layout with delta wings was undoubtedly the key to success.

The MiG-21 reinforced the Mikoyan OKB's position as an authoritative 'fighter maker'. The West German aviation magazine *Flug Revue* and its sister publication *Flugwelt* wrote thus in the 1970s: *'The Soviet MiG-21 series-built fighter is more than just a weapon. It has become a political weapon.'*

The final versions of the MiG-21 remained in production until 1986. The type holds 17 world records, seven of which were established by female pilots – N. A. Prokhanova, Yevgeniya N. Martova and Svetlana Ye. Savitskaya (the latter subsequently became an astronaut). Like some of its predecessors, the MiG-21 earned the affectionate nickname samolyot-soldaht – 'soldier aircraft', that is, a Real Fightin' Aeroplane; and indeed, it flew in defence of its homeland for more than 30 years.

As of this writing, the MiG-21 has more than 50 years on its tail; yet it still soldiers on, and not only in third-world countries but also in Romania, which is now a NATO member. Some other new NATO members, such as the Czech Republic, have retired the type only recently. This, in the authors' opinion, is ample proof that the MiG-21 turned out to be a highly successful aircraft.

PART ONE

THE ORIGIN OF THE FAMILY

Ye-1 (Kh-1) tactical fighter (project)

In the early 1950s MAP's experimental plant No. 155 and its design bureau (the Mikoyan OKB, or OKB-155) began development of a light tactical fighter offering capable of speeds up to Mach 2 and having a service ceiling of 20,000 m (65,620 ft). At that time the Soviet aircraft industry was actively exploring the relative advantages and weaknesses of thin swept wings having a leading-edge sweep of 55-57° and delta wings, as well as refining the methods of flight control at transonic speeds and supersonic speeds up to Mach 1.7. Large-scale research into powerplants was also conducted, with numerous turbojet engines being tried and various supersonic air intake designs being explored.

Since the properties of thin swept wings and delta wings alike at high supersonic speeds had not yet been fully studied at the time, MAP chose to task two of the Soviet 'fighter makers' with developing and testing fighter prototypes featuring both types of wings for comparative evaluation. The design bureaux in question were OKB-51 headed by Chief Designer Pavel O. Sukhoi and OKB-155 under Chief Designer Artyom I. Mikoyan.

In 1954 the Mikoyan OKB completed the preliminary design (PD) project of a light fighter designated Ye-1, the Ye prefix standing for *yedinitsa* (unit, or single aircraft); some official documents also quote the designation Kh-1 for this project. The aircraft had swept wings featuring one-piece leading-edge slats and a conventional tail unit with no ventral fin(s) augmenting the vertical tail. The fighter was designed around a single Mikulin AM-5A non-afterburning axial-flow turbojet; however, with a thrust of only 2,000 kgp (4,410 lbst), this engine could not provide the required performance. Therefore, that same year the project was swiftly reworked to take a different engine; the result was the Ye-2 supersonic tactical fighter.

Ye-2 (Kh-2) tactical fighter prototypes

Originally known in-house as the Kh-2 but soon redesignated Ye-2, the PD project of a new tactical fighter was evolved from the Ye-1 (Kh-1)

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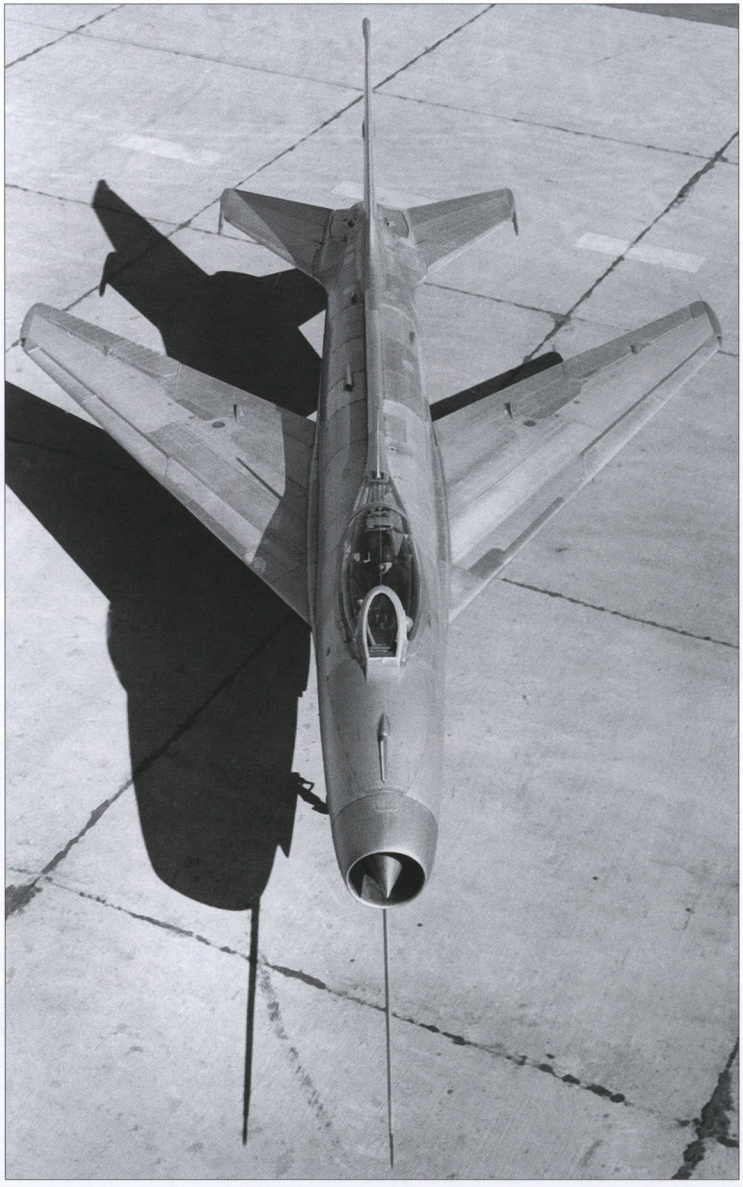
The first prototype of the Ye-2 experimental fighter. These photos show clearly the sharply tapered rear fuselage and the small nozzle of the AM-9B engine. Note the twin splayed ventral fins, the airbrake below the wing root and the strake-like aerial of the Radal'-M radar ranger ahead of the canopy.
▼►

RSK MiG

within a remarkably short time. It differed from the precursor primarily in having a new powerplant – a Mikulin AM-9B afterburning turbojet rated at 2,600 kgp (5,730 lbst) dry and 3,250 kgp (7,165 lbst) reheat. This axial-flow turbojet created by Aleksandr A. Mikulin's OKB-300 powered the twin-engined Mikoyan MiG-19 supersonic tactical fighter which had just entered production. Actually the Ye-2 had been designed with the even more powerful AM-11 afterburning turbojet in mind, but this engine was suffering development problems and would not be available in time. Hence the AM-9B was used as a stopgap, allowing the initial flight tests to begin so that the Ye-2's aerodynamics and flight control system could be verified.

When designing the Ye-2 (Kh-2), the engineers strove to pack the powerplant and systems into the smallest possible airframe, minimising the fuselage cross-section which was only just large enough to accommodate the engine and the cockpit enclosed by a low-drag bubble canopy. The oval-section fuselage was built in two pieces – Section F1 (the forward/centre fuselage) and Section F2 (the rear fuselage). The latter was strongly tapered and could be detached at the fuselage break point, exposing the engine for maintenance or removal, just like on earlier Mikoyan swept-wing jets. The tapered fuselage nose incorporated an axisymmetrical air intake featuring a movable centrebody or shock cone. The fuselage structure included 36 frames which were spaced unequally, with a maximum pitch of 750 mm (2 ft 5$^{33}/_{64}$ in) in the forward fuselage. Large stressed structural panels measuring up to 750 x 450 mm (2 ft 5$^{33}/_{64}$ in x 1 ft 5$^{23}/_{32}$ in) were used because the fuselage housed multiple bag-type fuel tanks.

The wings, swept back 55° at quarter-chord, had a thickness/chord ratio of 6% and a two-spar structure with stressed skins of variable thickness. The trailing edge was occupied by hydraulically actuated slotted flaps and two-section ailerons; the latter were aerodynamically balanced and operated in concert with roll control spoilers. The outer portions incorporated two-section automatic leading-edge slats with a skin thickness of 5.5 mm (0$^{7}/_{32}$ in). The tail unit included all-movable (one-piece) stabilisers or stabilators, which also had 55° sweepback at quarter-chord; the stabilators were rigidly attached to a beam or axle rotating in roller bearings inside the fuselage. The vertical tail was swept back 60° at quarter-chord and augmented by two splayed ventral fins. The fuselage incorporated two airbrakes located below the wing leading edge.



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▲
This view of the Ye-2 shows the sharply swept wings without boundary layer fences, the anti-flutter booms at the stabilator tips and the bubble canopy giving excellent all-round visibility. The air intake shock cone is all-metal.

It has to be said that the Ye-2 was a very refined design from a structural weight standpoint. For example, the specific structural weight per 1 m^2 of the Ye-2's wing structure was 4-5 kg (8.8-11 lb) lower as compared to the production MiG-19.

The cockpit canopy design and ejection seat were based on those developed for the Mikoyan I-3 fighter prototype. Designated Yel3, the latter's ejection system had been developed by LII's specialists; the Mikoyan OKB had presented the system to the mock-up review commission

▶ **Detail views of the original Ye-2. Top row: The cockpit canopy with the seat removed; note the fixed bulletproof windscreen. Centre left: The wing leading-edge slat and slotted flap. Below left: The main and nose gear units. Centre right: The tail unit. Below right: The MiG-19 style engine maintenance panels.**

▲ **Mikoyan OKB test pilot Gheorgiy K. Mosolov who test-flew the Ye-2.**

Another view of the Ye-2 *sans suffixe*. Note the transponder fairing on the fin. ▼

assessing the I-3's advanced development project (ADP) in April 1954. The ejection system utilised a one-piece cockpit canopy hinged at the front; when the ejection seat fired, two hooks on the headrest engaged two lugs at the rear of the canopy, rotating it upwards and disengaging the pivots at the front so that the canopy departed together with the seat, acting as a slipstream shield for the pilot. The canopy incorporated a triplex silicate glass windscreen which was electrically de-iced. The volume of the pressurised cockpit was 1 m^3 (35.31 cu ft).

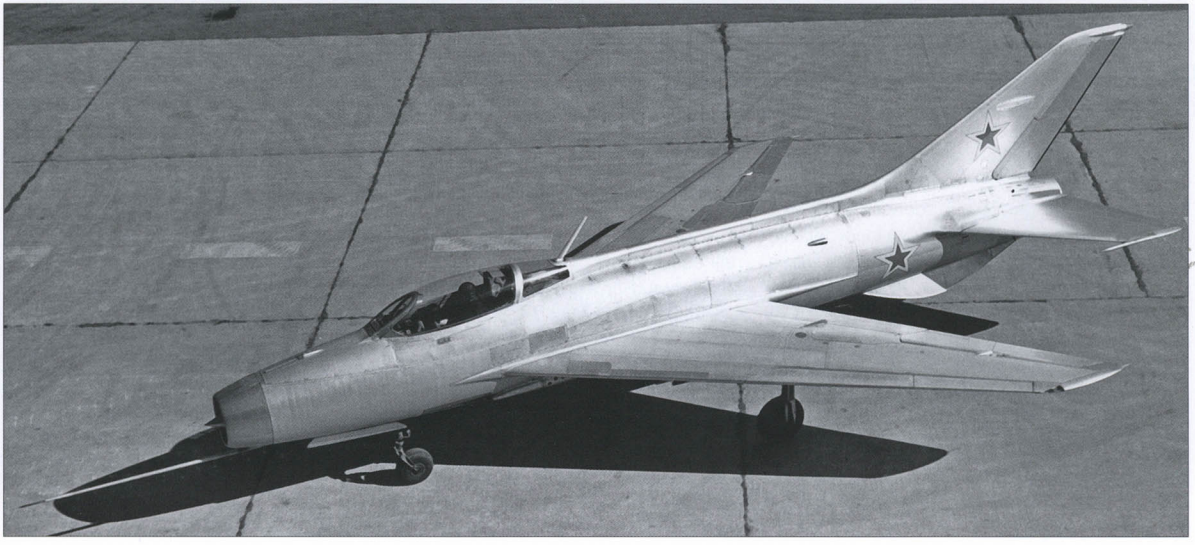
The flight control system utilised rigid push-pull rods throughout; the rudder control rods were housed in a slender fuselage spine running all the way from the cockpit canopy to the fin leading edge. The stabilators were powered by a single hydraulic actuator accommodated in the fin's root section.

The AM-9B afterburning turbojet had a variable nozzle controlled by several hydraulic rams. The engine bay and the afterburner in particular were cooled by ram air; on the ground the cooling air was supplied by suction (the Ye-2 had an ejector-type nozzle).

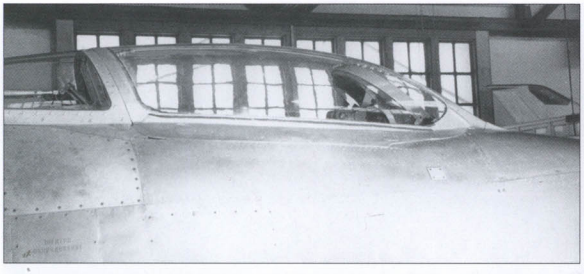
Most of the internal fuel was accommodated in the fuselage in several bladder tanks augmented by two integral tanks in the wings; the fuselage tanks were divided into four groups which were isolated for greater survivability. Another survivability enhancing feature was the provision of special shut-off valves in the fuel system allowing the engine to switch rapidly to a different group of tanks, should the current one be disabled by a hit. Additionally, the Ye-2 could carry a single drop tank on a centreline pylon.

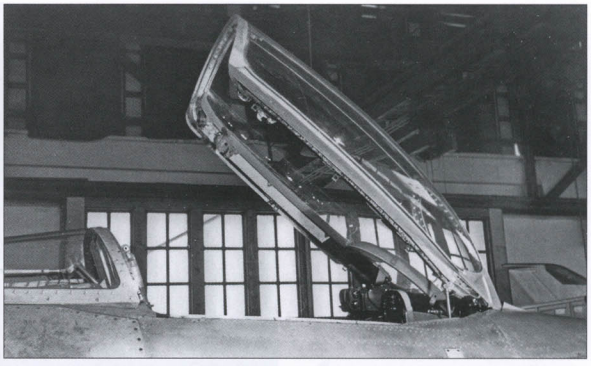
The Mikoyan engineers succeeded in developing a main landing gear that folded into a remarkably small space when retracted. The inward-retracting main units were so designed that the mainwheels rotated through 87° around the oleos to stow almost vertically alongside the engine's inlet duct. The fuselage cross-section was so small that the mainwheels could not be accommodated entirely inside it, so special bulges had to be made above and below the wing roots in the area of the mainwheel wells. The oleo struts folded into narrow recesses between the wing tanks and the rear spar to which the flaps were attached. This design, which gave a substantial weight saving, later found use on several other Mikoyan fighters. The nose unit retracted forward. All three wheels were equipped with brakes.

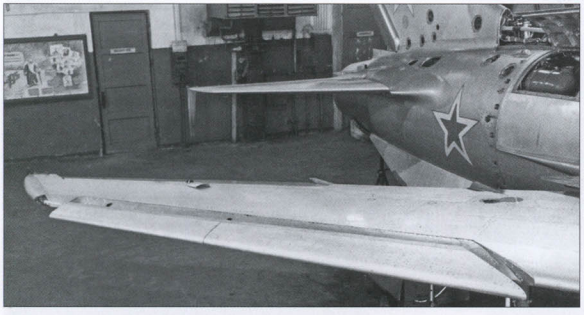
The Ye-2 was armed with a trio of 30-mm (1.18 calibre) Nudelman/Rikhter NR-30 cannons buried in the forward fuselage aft of the nose gear unit; two of the cannons were located on the starboard side in a staggered arrangement (the inboard weapon was mounted further aft) and the third cannon on the port side. The cannons were belt-fed, each with its own curved magazine following the fuselage contour; the magazines were located in the empty space between the fuselage frames. A belt link collector was provided. In maximum take-off weight configuration the fighter could also carry a single UB-16-57 rocket pod with sixteen 57-mm (2.24-in) ARS-57 *Skvo**rets*** (Starling) folding-fin aircraft rockets (FFARs) on the centreline pylon. (UB = *oonivers**ahl'**nyy blok* – versatile [rocket] pod – that is, for use both by fixed-wing aircraft and by

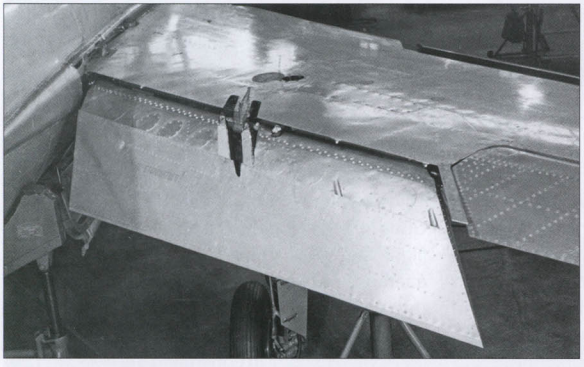


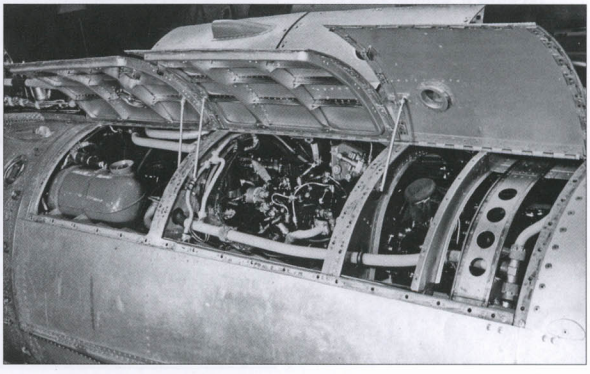
RSK MiG

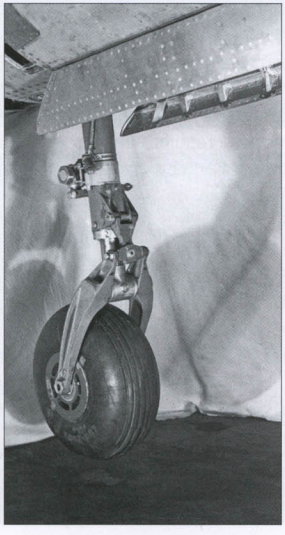


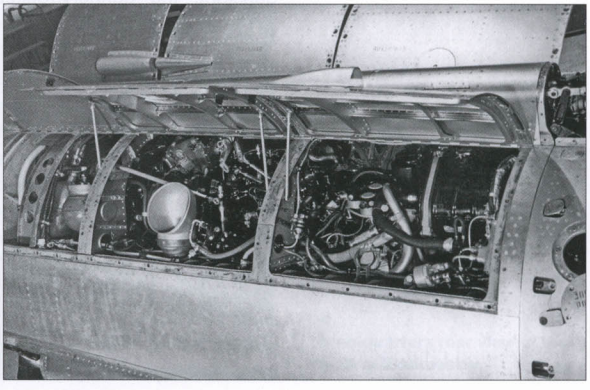




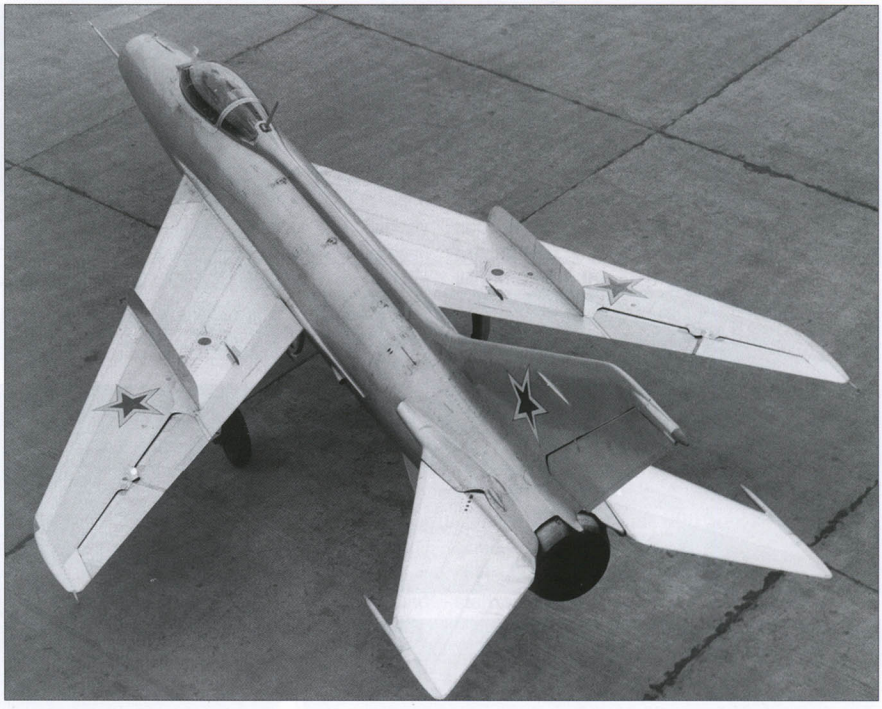








All photos RSK MiG



RSK MiG

This view of the Ye-2A shows the main differences from the Ye-2 *sans suffixe*: the larger nozzle of the R11-300 engine and the wing fences. Note the engine cooling air scoops blended into the root fairings of the high-set stabilators and the radar warning receiver antenna on top of the fin.

helicopters; ARS = *aviatsi**on**nyy reak**tiv**nyy sna**ryad*** – aircraft rocket.)

The basic avionics and equipment fit included an RSIU-4 VHF radio, an ***Oo**zel* (Knot) identification friend-or-foe (IFF) interrogator, an ARK-5 Amur automatic direction finder with an RUP landing approach computing module, an MRP-48P ***Dya**tel* (Woodpecker) marker beacon receiver facilitating poor-weather approach, an SRO-2 Khrom (Chromium) IFF transponder and a *See**rena**-2* (Siren) radar warning receiver alerting the pilot that his aircraft was being 'painted' by enemy radars. The weapons were aimed by means of an SRD-1M *Ra**dal'**-M* radar rangefinder linked to an ASP-5N computing gunsight; the gunnery/rocket launch results were recorded by an AKS-5 ciné-camera and an SSh-45 gun camera. (Notes: ARK = *avtoma**tich**eskiy **rah**dio**kom**pas* – ADF; Amur (pronounced like the French word *amour*) is a river in the Russian Far East. RUP = *re**sha**yushcheye oo**stroy**stvo po**sahd**ki*; SRO = *samo**lyot**nyy **rah**diolokatsi**on**nyy ot**vet**chik* – aircraft-mounted radar responder; SRD-1 = *samo**lyot**nyy **rah**diodal'no**mer*** – aircraft-mounted radio rangefinder (Radal' is a contraction of *rahdiodal'nomer*); ASP = *avtoma**tich**eskiy strel**kov**yy pri**tsel*** – computing gunsight; AKS = *appa**raht** kino**syom**ochnyy* – ciné-camera.)

The Ye-2 prototype was completed on 25th December 1954. After a brief ground test programme the fighter made its maiden flight on 14th February 1955 with Mikoyan OKB test pilot Gheorgiy K. Mosolov at the controls. Yet the flight test programme was abandoned shortly afterwards because the intended AM-11 turbojet (by then redesignated RD-11 for reaktivnyy dvigatel' – jet engine) had become available; there was no point in continuing the tests with the lower-powered provisional engine. (The change in the designations of various Mikulin turbojets from AM to RD was due to the fact that Aleksandr A. Mikulin had fallen from grace and had been removed from office; as part of the retribution, his initials were eliminated from the designations of his engines.)

Ye-2A (MiG-23) tactical fighter (*izdeliye* 63)

In 1955 the Ye-2 prototype was suitably modified to take the RD-11 turbojet with a 3,800-kgp (8,380-lbst) dry rating and a 5,100-kgp (11,240-lbst) afterburner rating, whereupon the designation was amended to Ye-2A. At the same time the Mikoyan OKB's prototype construction facility was hard at work manufacturing another fighter prototype; this aircraft, which bore the manufacturer's designation Ye-5, differed from the Ye-2 primarily in having delta wings instead of swept ones and will be dealt with later. The

RSK MiG

◀ The Ye-2A at Zhukovskiy with the canopy open. The twin ventral fins are visible.

RSK MiG

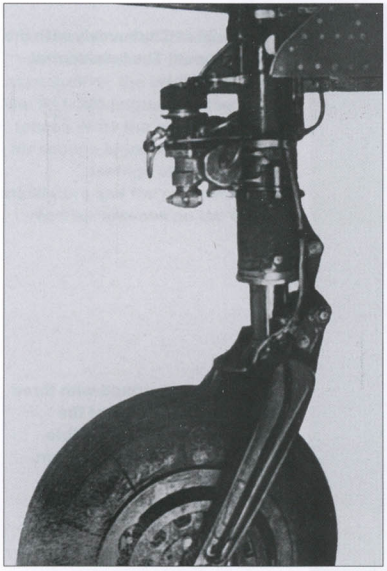
◀ The Ye-2A was armed with three cannons. The fairing of the centre cannon is just visible below that of the port cannon.

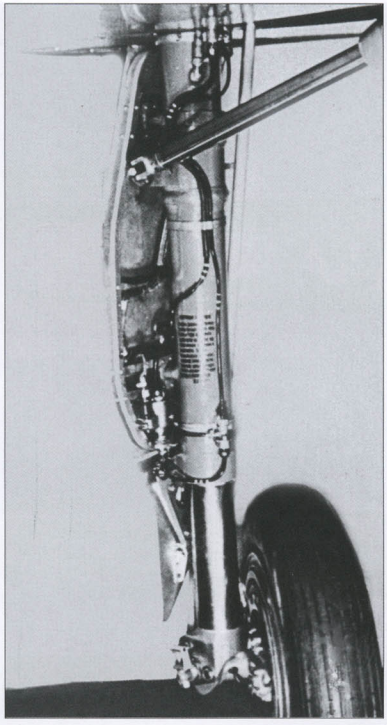
RSK MiG

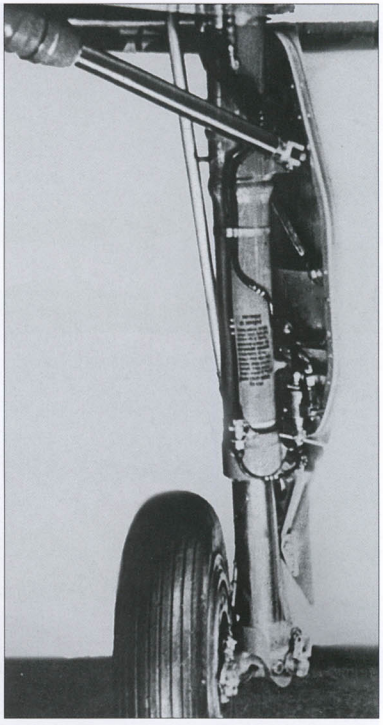
◀ The Ye-2A wore the national insignia on the wings and tail but not on the rear fuselage. Like the Ye-2 *sans suffixe*, it wore no tactical code.

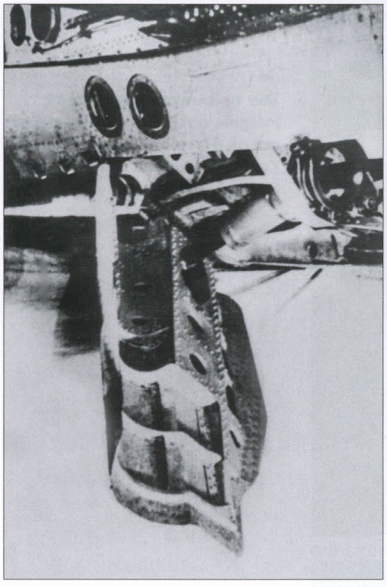
RSK MiG

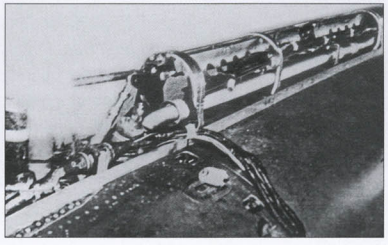
◀ Three-quarters rear view of the Ye-2A at Zhukovskiy.

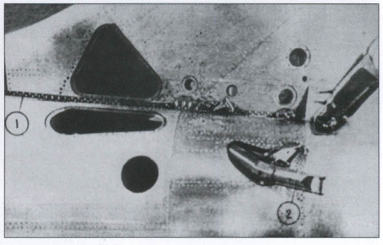












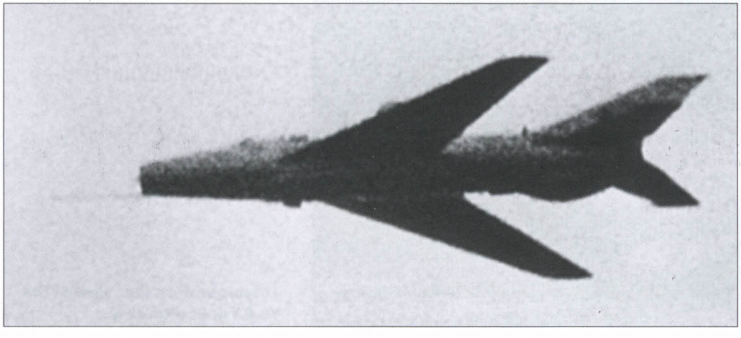
▲▲
The nose and main landing gear units of the Ye-2A. Note the brake drums.

▲
The fuselage spine and the port side of the fin root. Note the stabilator mounting beam.

◄
The port airbrake of the Ye-2A.

The Ye-2A making a flypast at Moscow-Tushino on 26th July 1956. The airbrakes are open.

▼



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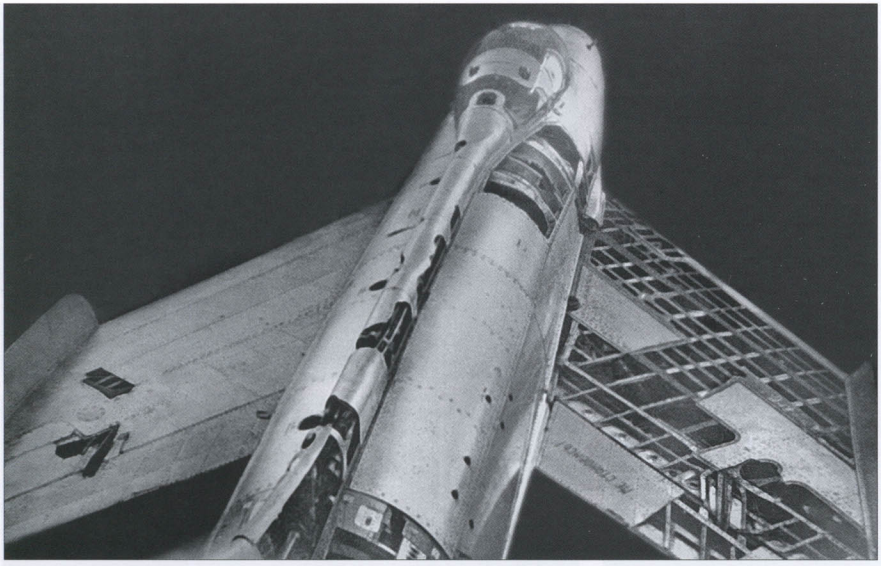
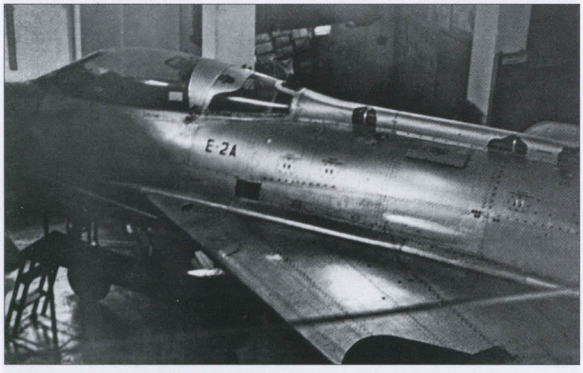
Ye-5 was designed around the AM-11 (RD-11) engine from the outset; also, much of the two fighters' airframe structure was absolutely identical. Thus, the designers were able to complete a set of manufacturing documents and modify the Ye-2 to Ye-2A configuration within a very short time.

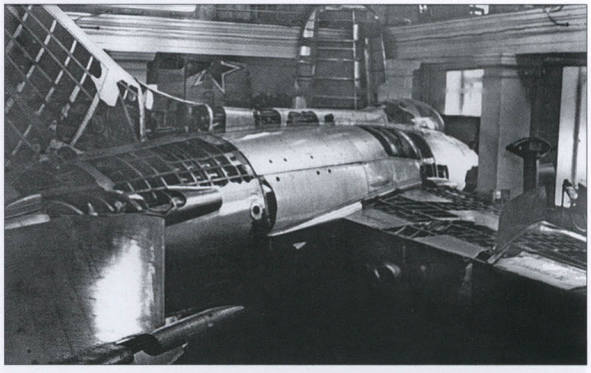
According to the 1955 Technical Report of plant No. 155, the only difference between the Ye-2A and the Ye-5 lay in the wing design. In accordance with the project documents the fuselage fuel tanks of the re-engined fighter

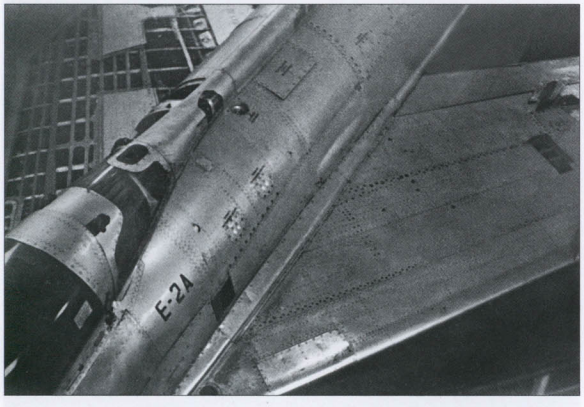


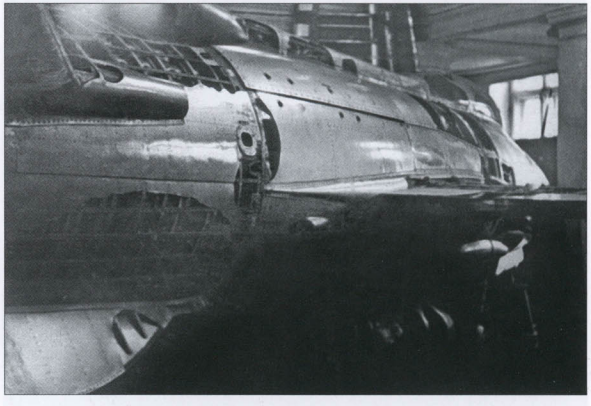
◄
Ye-2A c/n N63210104 ended up as a cutaway instructional airframe at the Air Force Engineering Academy (VVIA) in Moscow. The wing structure is clearly visible; the wing ribs are at right angles to the rear spar while the flap ribs are parallel to the fuselage axis. The flap is marked Ne stanovis'! (No step!). Note the fuselage break point.

Here and overleaf: More views of the same cutaway Ye-2A; the designation is painted on the fuselage to avoid 'what-sort-of-beast-is-this' questions from the students. Note that the aircraft has a modified canopy with a wider rear frame that used to carry faired canopy locks (the fairings are removed).
◄ ▼









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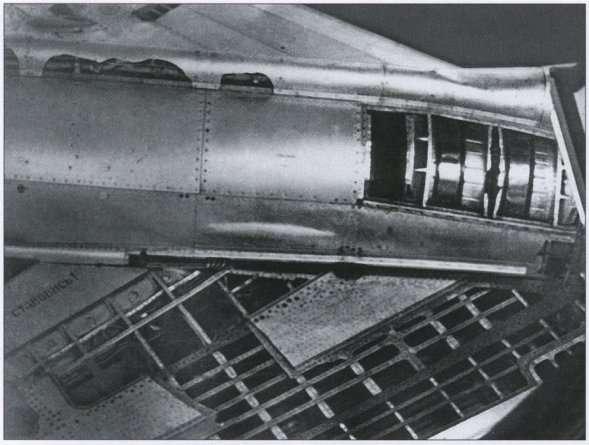
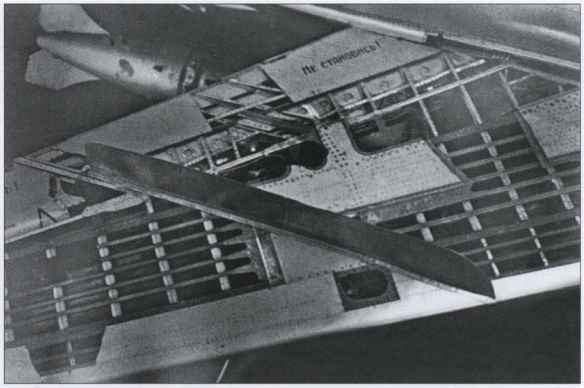
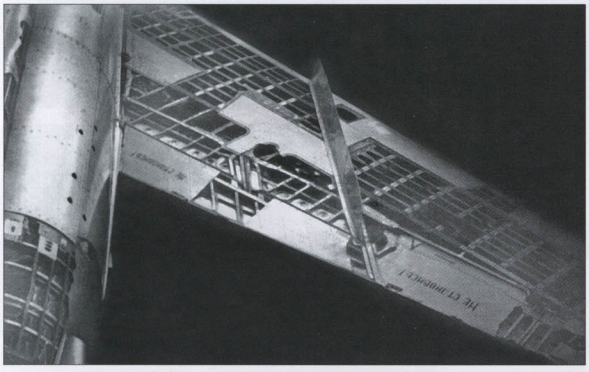
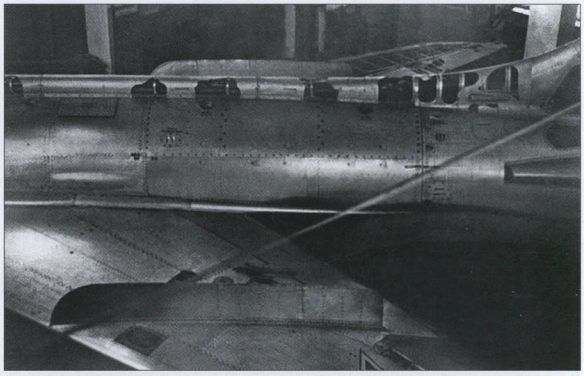
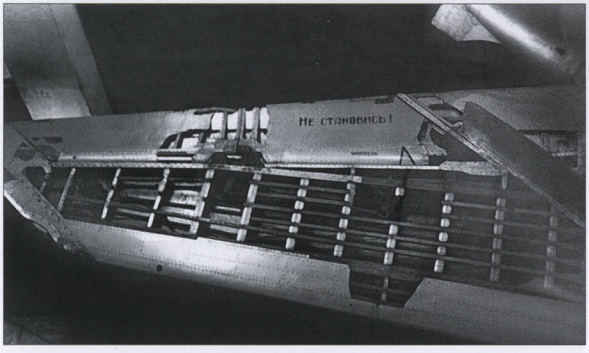
holding a total of 1,890 litres (415.8 Imp gal) were divided into four groups, just as had been the case with the original Ye-2; a 400-litre (88 Imp gal) drop tank could be carried. The Ye-2A's armament was identical to that of the Ye-2, comprising three NR-30 cannons with 60 rpg. The nose gear unit had a KT-38 wheel set in a fork while the main units were fitted with KT-27 wheels (*kole**so** tormoz**noye*** – brake-equipped wheel); all three wheels featured twin pneumatic

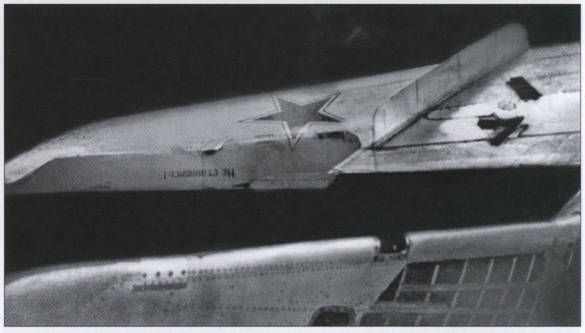


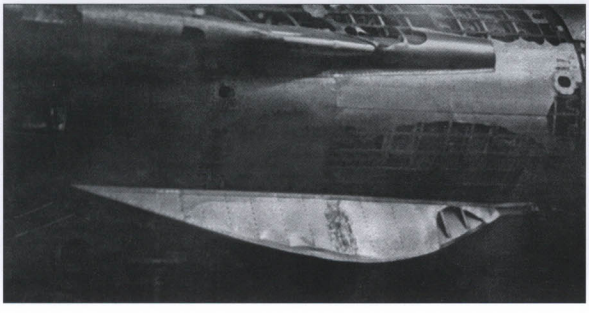


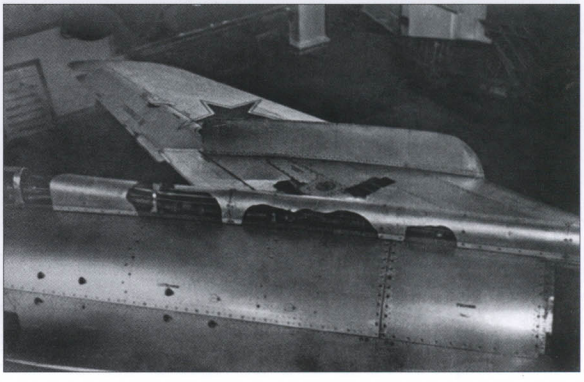












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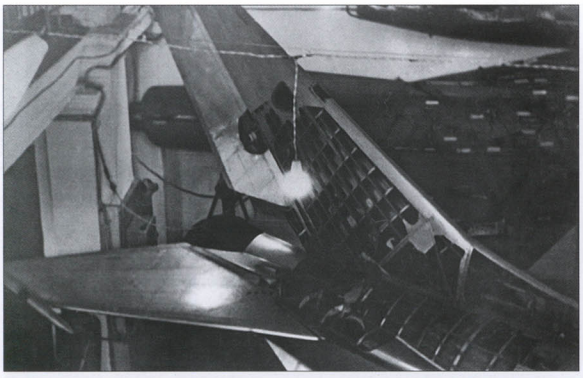

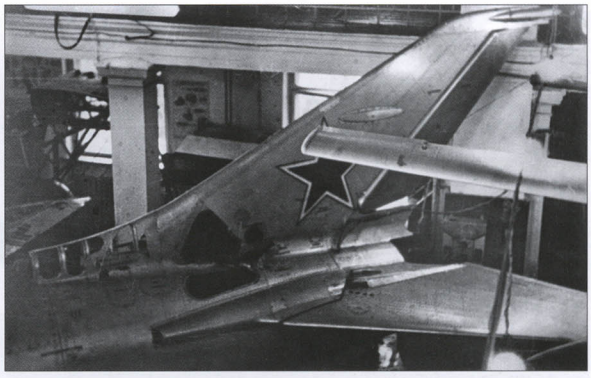

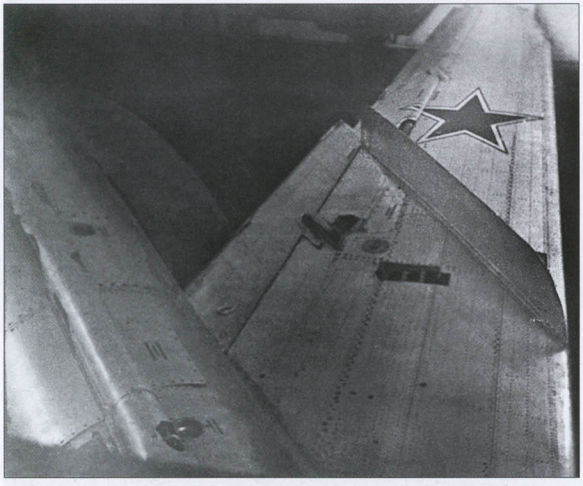

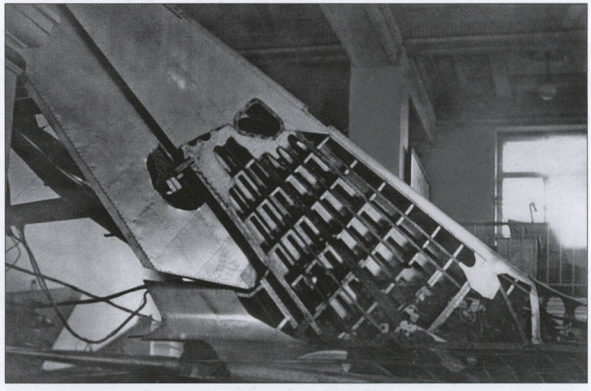

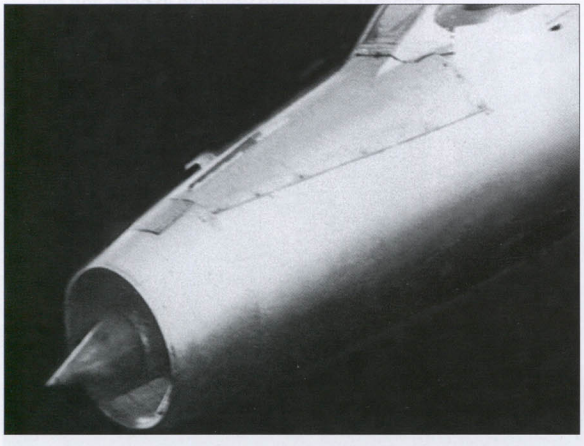

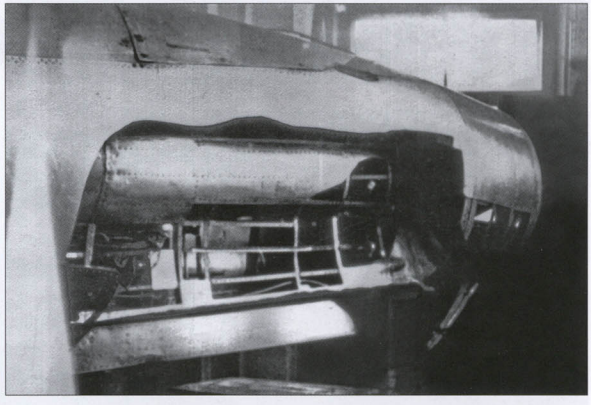

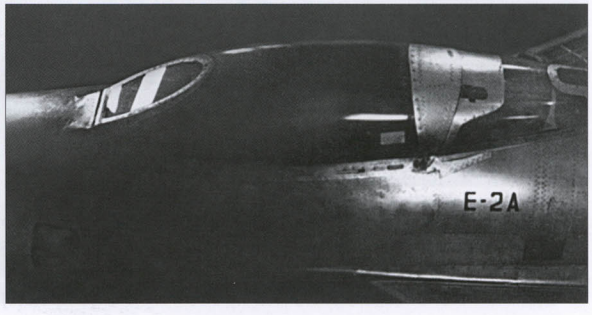

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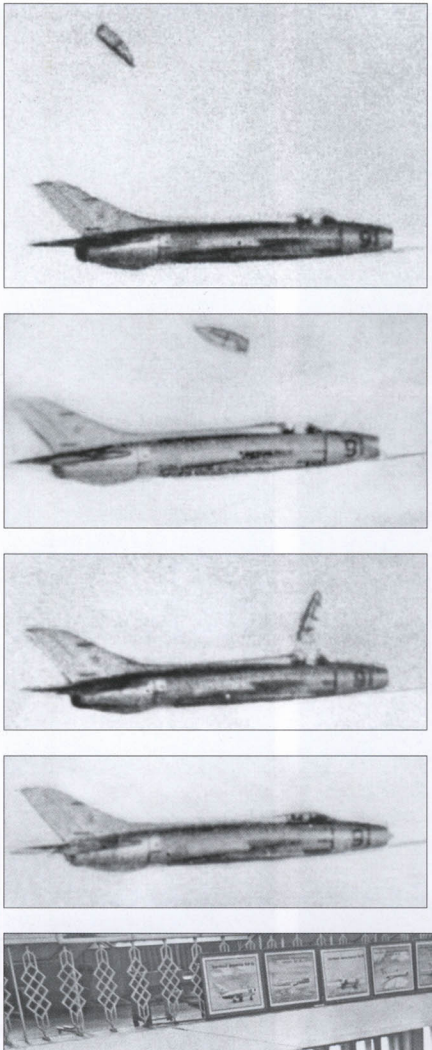

Yefim Gordon archive

▶ **This sequence of stills from a ciné film (from bottom to top) shows the canopy jettison system being verified on a Ye-2A coded '91 Red'.**

expander-tube brakes. The landing gear wheelbase was 4.41 m (14 ft 5⅝ in) and the wheel track 2.679 m (8 ft 9¹⁵⁄₃₂ in).

The Ye-2A had two independent hydraulic systems, one of which catered for the flight controls – the BU-44 hydraulic actuator powering the tailplanes and the BU-45 actuator working the ailerons; both actuators were of the non-reversible type. The air intake shock cone was likewise hydraulically actuated and had a travel of 182 mm (approximately 7¹¹⁄₆₄ in).

The avionics and equipment were similar to the Ye-2's; the modified fighter had an RSIU-4V radio, an ARK-5 ADF with an RUP module, an MRP-48P marker beacon receiver, a ***Bar**iy-M* (Barium) IFF transponder and a Sirena-2 RWR. The SRD-1M Radal'-M radar ranger worked in conjunction with a slightly different gunsight, the ASP-5N-V3. Primary electric power was supplied by a 9-kilowatt GSR-ST-9000A engine-driven generator, with a 12SAM-28 lead-acid DC battery as a back-up.

The changes were not limited to the powerplant. Unlike its lower-powered predecessor, the Ye-2A lacked the automatic leading-edge slats. Instead, a single boundary layer fence was installed on the upper surface of each wing at half-span to limit spanwise airflow, improving aileron efficiency at high angles of attack (high alpha). One good reason for this redesign was the Ye-2's erratic behaviour if the automatic slats deployed asymmetrically – for example, in a sideslip; the aircraft would jerk sharply, becoming unstable in pitch and roll.

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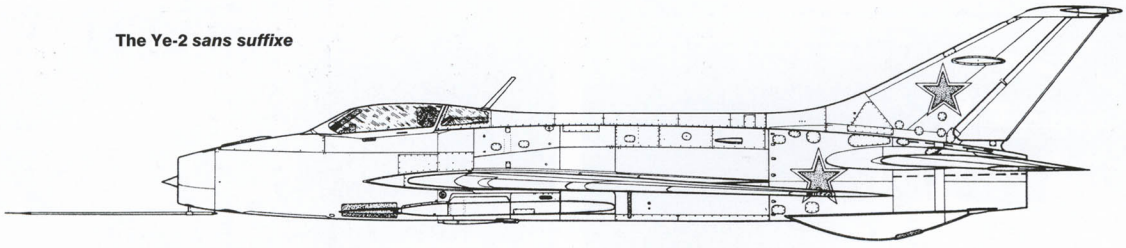
▶ **Another partially dismantled Ye-2A serving as a teaching aid (probably at the Khar'kov Aviation Institute). The canopy lock fairings are in place on this aircraft. The machine shares the instruction hall with a Yakovlev Yak-25 interceptor and parts of other aircraft, including a MiG-15 and a MiG-21 whose wing panel is seen on the left.**

All photos by Victor Drushlyakov

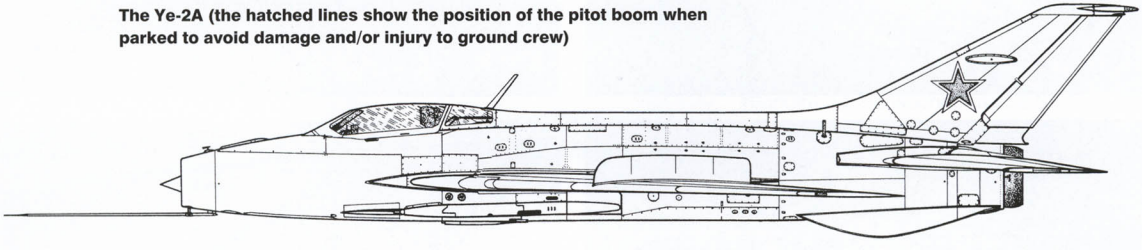
◄ ▲

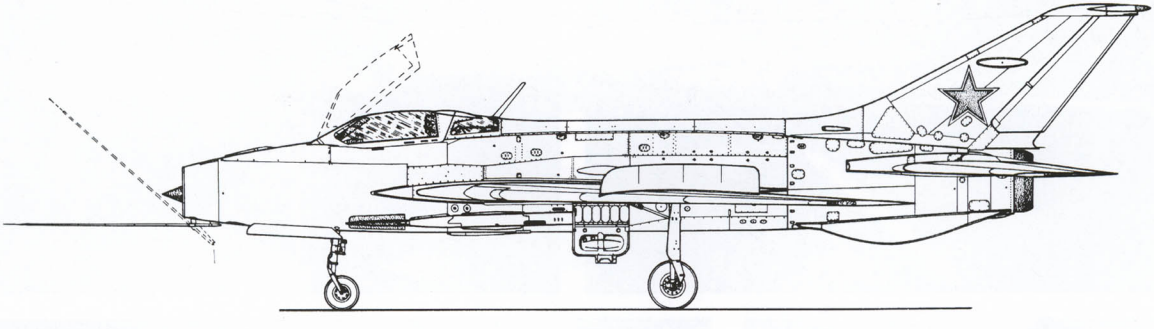
Yet another cutaway Ye-2A, this time at an aviation technical school in Moscow. The red-painted areas on the stabilator are 'mind your head' caution markings for the students. The ejection seat headres bears the stencil 0632 – that is, izdeliye 63 No. 2.

The Ye-2 *sans suffixe*

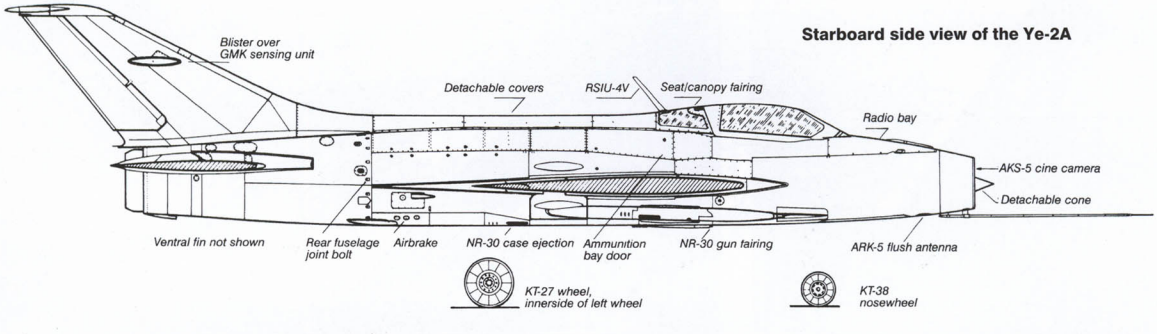


The Ye-2A (the hatched lines show the position of the pitot boom when parked to avoid damage and/or injury to ground crew)

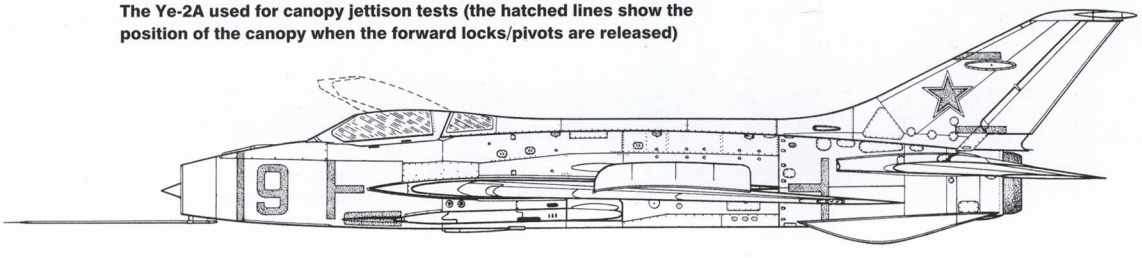


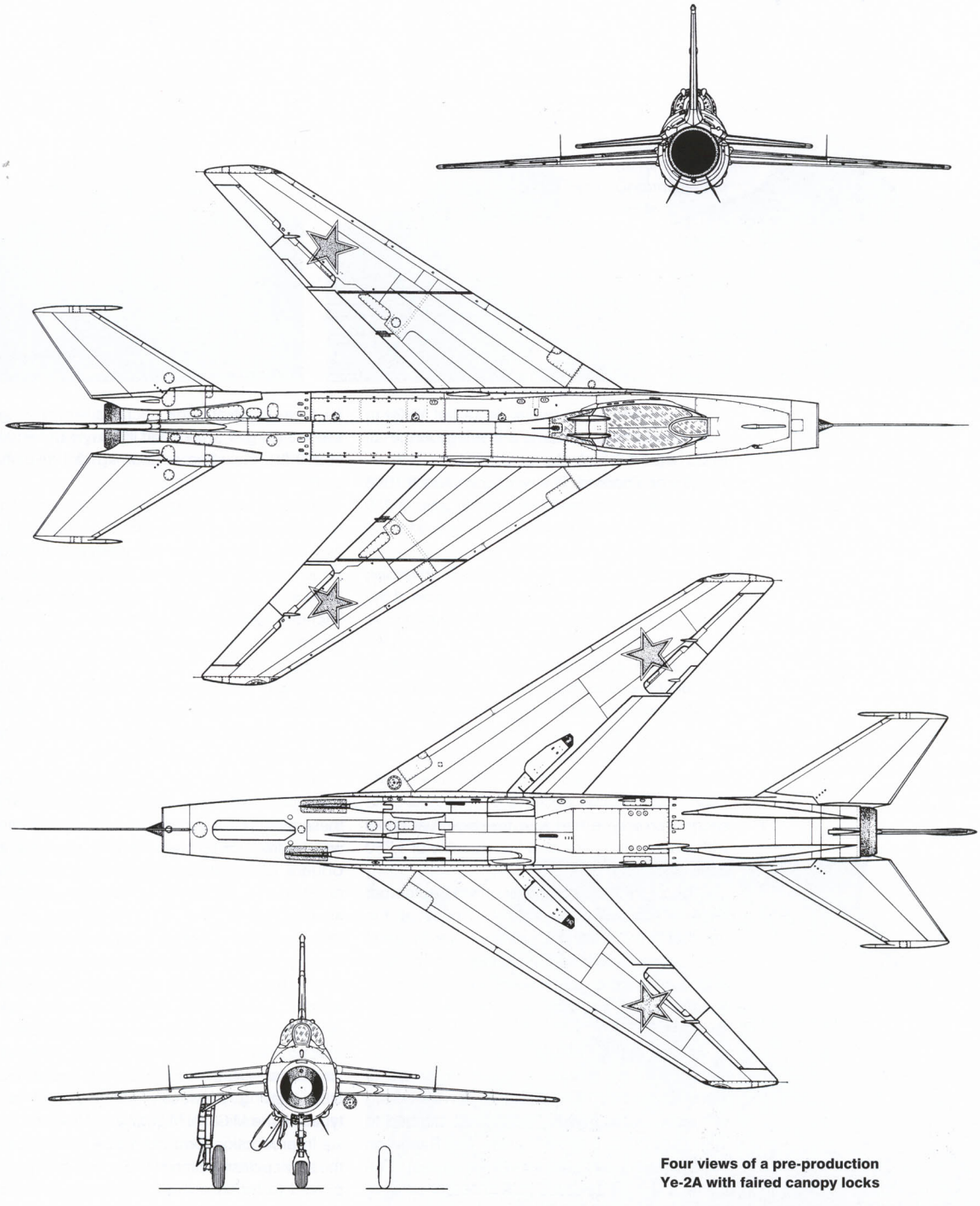


Starboard side view of the Ye-2A



The Ye-2A used for canopy jettison tests (the hatched lines show the position of the canopy when the forward locks/pivots are released)





Four views of a pre-production Ye-2A with faired canopy locks

All photos RSK MiG

▲ ►
The test pilots who flew the Ye-2A. Left to right: Col. Gheorgiy K. Mosolov, Col. Gheorgiy A. Sedov and Maj. Vladimir A. Nefyodov.

The Ye-2A had an overall length of 13.23 m (43 ft 4⁵⁵⁄₆₄ in) less pitot and a fuselage length of 11.33 m (37 ft 2¹⁄₁₆ in), standing 4.082 m (13 ft 4⁴⁵⁄₆₄ in) tall when parked. The wing span was 8.1098 m (26 ft 7⁹⁄₃₂ in) and the horizontal tail span 3.726 m (12 ft 2⁴⁵⁄₆₄ in); the wing area was 21.0 m² (226.04 sq ft).

The Ye-2A made its first post-conversion flight on 17th February 1956 at the hands of the Mikoyan OKB's chief test pilot Gheorgiy A. Sedov. The same pilot flew the Ye-2A when it led a large line astern formation of experimental aircraft at the 1956 Tushino flypast on 26th July.

Meanwhile, in keeping with an MAP order, the Mikoyan OKB had started construction of the second prototype; designated Ye-2A/2, this aircraft was completed on 28th July 1956. According to OKB documents, the new-build second prototype had four fuselage fuel tanks with a maximum permitted fuel quantity of 1,760 litres (387.2 Imp gal).

The Ye-2A/2 took to the air on 4th September 1956, again with Gheorgiy A. Sedov at the controls. The flight tests proceeded with frequent interruptions because the powerplants of both prototypes were functioning unsatisfactorily, necessitating frequent unscheduled engine changes.

In the course of the manufacturer's flight tests the Ye-2A attained a maximum speed of 1,900 km/h (1,180.6 mph) and a service ceiling of 18,000 m (59,055 ft); the aircraft climbed to 10,000 m (32,810 ft) in 7.3 minutes. Range on internal fuel was 2,000 km (1,242 miles). The fighter's unstick speed and landing speed were 305 km/h (189.5 mph) and 280 km/h (174 mph) respectively. The Ye-2A had a 6,250-kg (13,780-lb) take-off weight; the aircraft's empty weight was 4,340 kg (9,570 lb) and the payload 1,910 kg (4,210 lb), including a 1,450-kg (3,120-lb) fuel load.

Among other things, the second prototype served for testing the cannon armament and its new features, namely the ammunition magazines curved around the fuselage sides and the cannons' muzzle brakes. Because the fighter's intended ejection seat was still undergoing trials on the aforementioned ST-10 testbed (a specially modified UTI MiG-15 trainer), the Ye-2A was temporarily equipped with a stock Mikoyan KK-2 ejection seat of the type fitted to the MiG-19. This seat was fired by pulling down a special protective face blind.

On 31st December 1957 the Ye-2A/2 was submitted for State acceptance trials. While these were still in progress and the programme was far from completed, on 11th July 1958 the Council of Ministers let loose with a directive ordering the Ye-2A into production at MAP's aircraft factory No. 21 named after Sergo Ordzhonikidze in Gor'kiy (now renamed back to Nizhniy Novgorod). MAP followed up a week later with an order to the same effect. The Gor'kiy aircraft factory – now called NAZ Sokol (*Nizhego**rod**skiy aviatsi**on**nyy za**vod** '**Sok**ol'* – 'Falcon' Nizhniy Novgorod Aircraft Factory) – was a well-established partner of the Mikoyan OKB, having previously manufactured such types as the MiG-15, MiG-17 and MiG-19.

In production form the Ye-2A was allocated the service designation MiG-23. This designation proved to be short-lived and would be reused first for the Ye-8 experimental fighter (see Chapter 6) and later for a much more advanced

tactical fighter with variable-geometry wings known in the West as the *Flogger*. The in-house product code at the Gor'kiy factory was *izdeliye* 63. Production fighters were to differ from the prototypes in having a new SRD-5M ***Ba**za-6* (Base) radar rangefinder instead of the SRD-1M, an SRO-2 Khrom IFF transponder instead of the Bariy transponder, a KKO-1 oxygen equipment set (komplekt kislorodnovo oboroodovaniya) and two 15STsS-45 silver-zinc DC batteries instead of a single 12SAM-28.

The Ye-2A (MiG-23) entered low-rate initial production in 1957. Although the definitive version of the production plan for that year envisaged the manufacture of 12 aircraft, only five were actually completed, with four more in various stages of assembly. All five aircraft were powered by R11-300 engines, as the RD-11 was designated in production form (some documents quote the designation RD-11-300). The manufacturing documents for the Ye-2A transferred by OKB-155 to the Gor'kiy factory stated an internal fuel capacity of 1,760 litres (387.2 Imp gal); the centreline pylon could alternatively carry a 400-litre (88 Imp gal) drop tank, a 16-round FFAR pod or a 250-kg (551-lb) FAB-250 high-explosive bomb.

The UB-16-57 FFAR pod was developed by the KB-1 design bureau located on the premises of plant No. 81; the design was based on the eight-round Model 5V pod used on the MiG-19. Additionally, the Mikoyan OKB planned to introduce wing hardpoints on the production Ye-2A (MiG-23) allowing the fighter to carry pods with ARS-57 or ARS-57M FFARs, as well as 190-mm (7.48-in) TRS-190 spin-stabilised aircraft rockets (***toor**boreak**tiv**nyy sna**ryad***), 212-mm (8.34-in) ARS-212M rockets and other unguided rockets in pods or on individual launchers, or bombs of up to 500 kg (1,102 lb) calibre. The Ye-2A's pylon was likewise designed by KB-1 to the Mikoyan OKB's specifications.

The Ye-2A/6 (the fifth and final Gor'kiy-built example) underwent manufacturer's flight tests, which were performed by Gheorgiy K. Mosolov, Vladimir A. Nefyodov, Gheorgiy A. Sedov and other pilots. Another production Ye-2A (construction number N63210103 – that is, *izdeliye* 63, plant No. 21, Batch 01, 03rd aircraft in the batch) was turned over to LII where it was used in a number of special flight test programmes, including dead-stick landings. Test pilot A. P. Bogorodskiy performed six dead-stick landings, demonstrating that a successful emergency landing in the event of an engine failure could be performed with no major trouble.

When the Ye-5 prototypes entered flight test, it quickly became apparent that the delta-wing version held greater promise. Therefore all further testing of the Ye-2A was undertaken in support of the Ye-5 programme. All in all, the Ye-2 and the Ye-2A prototypes and production fighters made 250 flights between them.

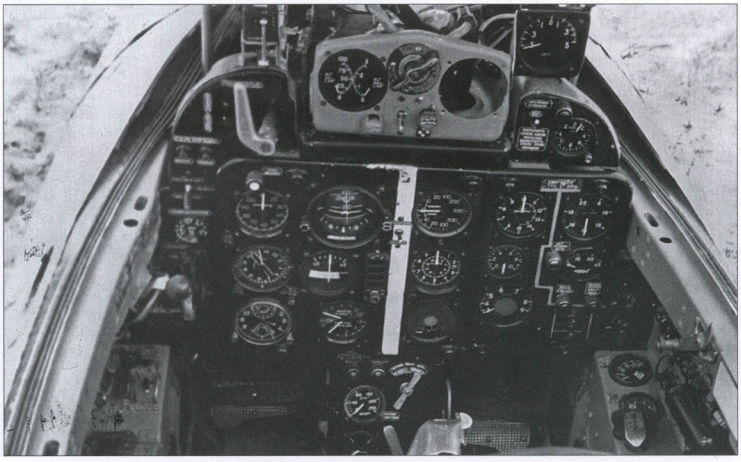
Some of the production Ye-2As were used in special test programmes, including canopy jettison trials. Eventually in 1958 the former MAP – by then renamed the State Committee for Aviation Hardware (GKAT – *Gosoo**dar**stvennyy komi**tet** po aviatsi**on**noy **tekh**nike*) – issued an order calling a halt to all further work on this aircraft. (Note: In 1957 MAP and several other ministries were 'demoted' to State Committees because of the Soviet leader Nikita S. Khruschchov's disdainful attitude to manned aviation and his predilection towards missile systems. After Khrushchov's ousting in 1965, however, GKAT regained its original name and 'rank' under the new Brezhnev administration.)

An uncoded production Ye-2A (c/n N63210104) became an instructional airframe – in all probability at the Khar'kov Aviation Institute. Another production example became a cutaway instructional airframe at a technical college. The ejection seat headrest of this aircraft was marked 0632, which might mean '*izdeliye* 63 No. 2' (that is, the second Gor'kiy-built example).

Ye-50 experimental high-altitude interceptor

In the mid/late 1950s the Soviet defence industry was confronted with the task of creating air defence systems capable of engaging targets flying as high as 20,000-21,000 m (65,620-68,900 ft). There was ample reason for that. As early as July 1956 the US Air Force's Lockheed U-2 high-altitude spyplanes started intruding into

The instrument panel of a Ye-50/1. The white line down the middle is for aligning the stick during spin recovery to make sure the ailerons are neutral. ▼



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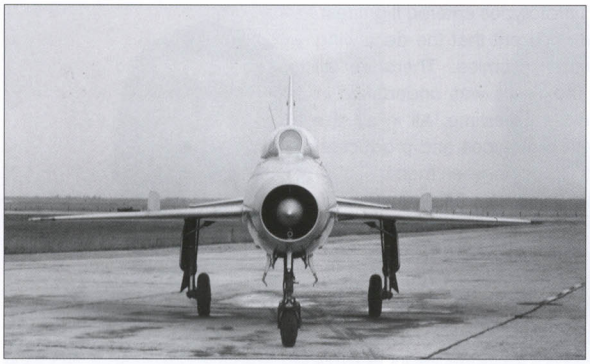
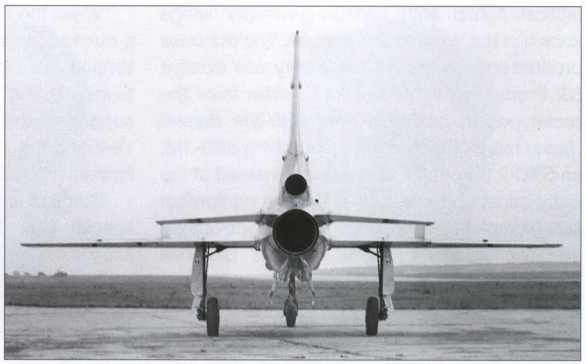
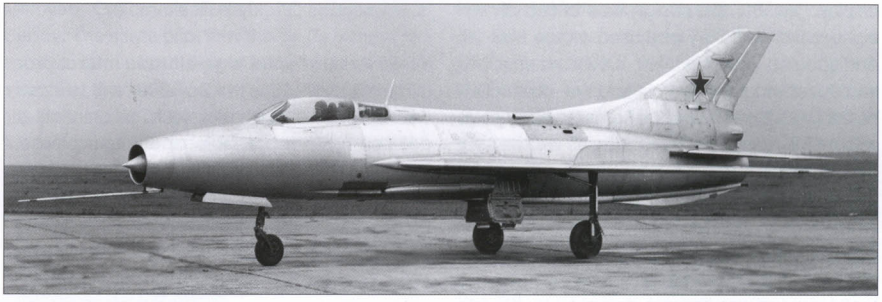




▲
Front view of the first prototype Ye-50 mixed-power interceptor.

►▲
Rear view of the Ye-50/1, showing the nozzle of the S-155 rocket booster above the turbojet's nozzle and the slight anhedral of the stabilators.



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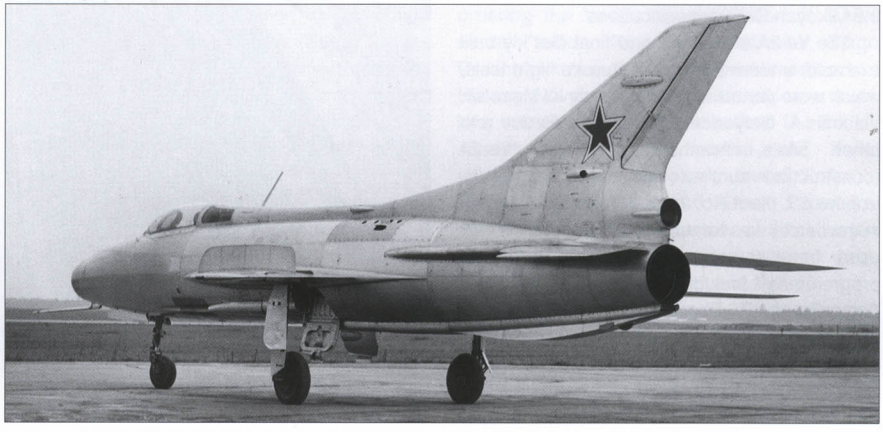
Two more views of the Ye-50/1. Here the aircraft is shown with the original canopy having a normal transparency and a Ye-2 style narrow rear frame.



►
This three-quarters rear view of the Ye-50/1 shows the enlarged fin fillet, the rocket booster housing, the original long rudder, the long fairings blending into the stabilator roots, the ventral conduit housing rocket fuel jettison lines and the shallow ventral strake.

All photos RSK MIG

Soviet airspace and regularly overflying strategically important locations, including Moscow. Of course, the Soviet government was determined to stop these incursions, but little could be done at the time. The U-2 was beyond the reach of Soviet air defence systems of the day, including the PVO fighter arm's MiG-17PF and MiG-19P all-weather interceptors whose service ceiling was much too low. The Soviet Union's first surface-to-air missile (SAM) system – the S-25 – was in existence but had not yet been fielded.

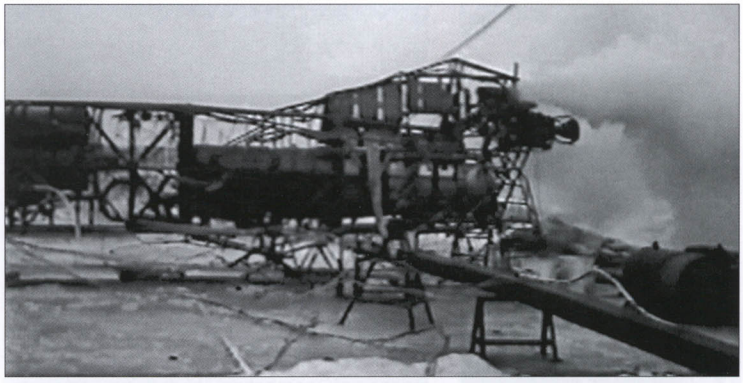
Back in 1953 Air Marshal Yevgeniy Ya. Savitskiy, Commander of the IA PVO, wrote thus to the then Minister of Defence, Marshal Nikolay A. Bulganin:

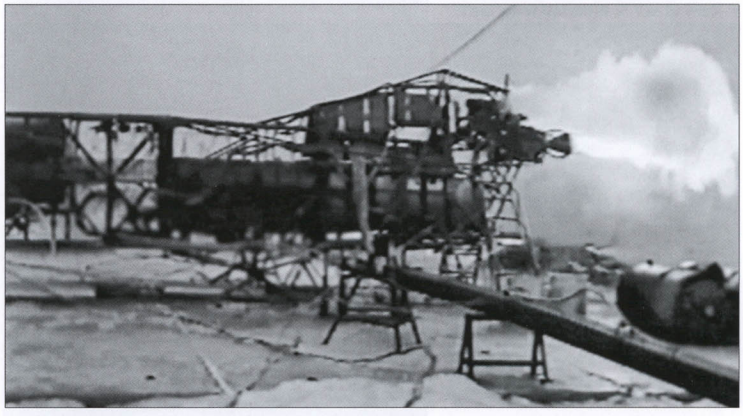
'Because of several major deficiencies in the ways how the PVO's fighter arm is equipped with combat hardware that is essential for organising proper air defence of the nation [...], I consider it my duty to report [...] that we are now clearly lagging behind in the field of tactical fighter design, no work being currently in progress to develop a new tactical fighter that would differ markedly from (read: be markedly superior to – Auth.) the MiG-15bis and the MiG-17. This gap in engineering levels could prove disastrous in the event of war. [...]

Turbojet-powered fighters with a service ceiling of 18,000-20,000 m [59,055-65,620 ft] cannot wage combat successfully at these altitudes and ensure the objective is completed, either. The thrust of a turbojet engine bleeds off as the flight altitude increases. If the [enemy] bombers are likewise powered by turbojet engines, this will endow them with considerable high-altitude performance. It is a well-known fact that the actual operational altitude of a jet fighter is almost invariably lower than the machine's service ceiling. Hence the combat capabilities (especially manoeuvrability) of a fighter at the limit of its altitude envelope will be severely limited.

That said, the objective of ensuring that our fighters are able to outperform the adversary's contemporary bombers at high altitudes can in all probability be attained only by equipping our fighters with mixed powerplants comprising a turbojet engine and a liquid-fuel rocket motor (the turbojet is to be the main engine). In the course of the last two years I have repeatedly pointed out the need to have an interceptor powered by a turbojet/rocket motor combination in the Air Force inventory both to MAP and to the Air Force. Yet, no action has been taken.

In my opinion, one of the main reasons for the current delay in tactical fighter development and for the impasse in the issue of the fighter with the turbojet/rocket motor combination lies in the fact that our military experts fail to reach an agreement on the type of fighter needed to combat modern adversary aircraft with equal





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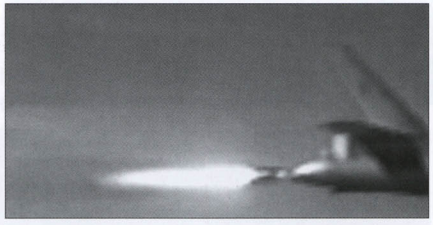
The Ye-50's powerplant underwent initial testing on this ground rig. Here the S-155 rocket booster is fired; the R11-300 turbojet is below it.



◄
Afterwards the S-155 was flight-tested on a specially modified Il'yushin IL-28R.

Overall view of the IL-28R engine testbed with the rocket booster in a fairing replacing the IL-K6 tail turret.
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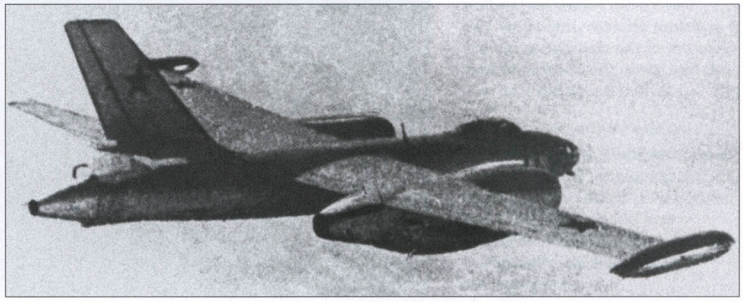

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success throughout the altitude range from sea level to 20,000 m.

Considering that the reliability of the nation's air defences currently hinges to a large extent on the performance of our fighter types, I deem it necessary to expedite immediately [...] the decision to design and build the prototype of an interceptor with a powerplant comprising a turbojet engine and a liquid-fuel rocket motor.'

Thus, as early as 1953 the PVO high command had come to the conclusion that in a situation when the work on SAM systems had just begun, mixed-power interceptors equipped with liquid-fuel rocket boosters were the only means of combating high-flying adversary aircraft. The idea was that the booster would only be ignited at the final stage of the target approach.

A decision to go ahead with an interceptor equipped with a rocket booster and capable of intercepting targets flying above 20,000 m (65,620 ft) was taken at the top government level in September 1953. Since the Soviet aircraft industry had no prior experience with such aircraft, the government decided to task the Mikoyan OKB with designing and building a technology demonstrator as a first step. This aircraft was to be intended for exploring the possibility of using mixed powerplants for reaching high altitudes. On 19th March 1954 the

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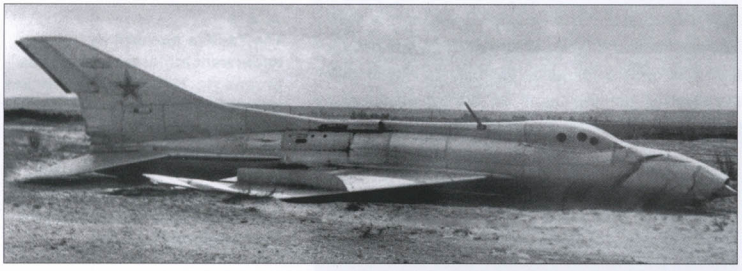

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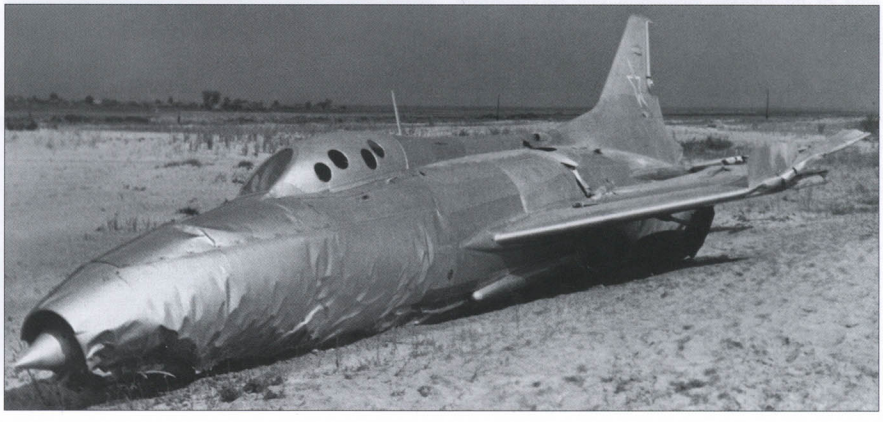
Council of Ministers and the Communist Party Central Committee issued joint directive No. 473-213 'On the development of an experimental aircraft for high-altitude supersonic research', which was followed on 24th March by MAP order No. 189. These documents required OKB-155 to build an experimental mixed-power derivative of the MiG-19 fighter and submit it for flight tests in May 1955. The CofM directive and the MAP order stipulated a maximum speed of 1,800-2,000

▲▲▲
LII test pilot Valentin G. Mookhin who flew the Ye-50.

▲▲►
The Ye-50/1 after its landing accident on 14th July 1956. The extent of the damage is clearly visible. Note the shorter rudder with a bendable trim tab.

▲►
Two more views of the Ye-50/1 at the crash site. Note the metal canopy with small portholes that was supposed to be heat-resistant at high Mach numbers but reduced the pilot's view dramatically.



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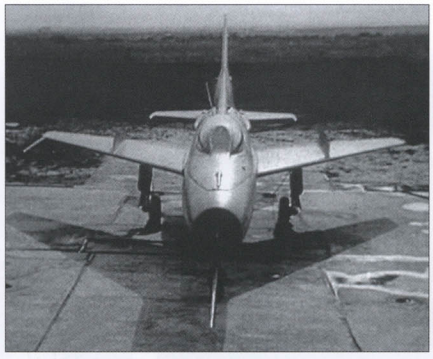
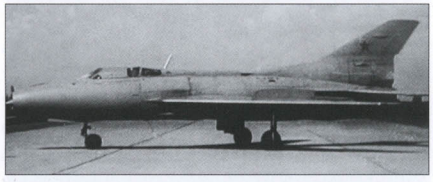




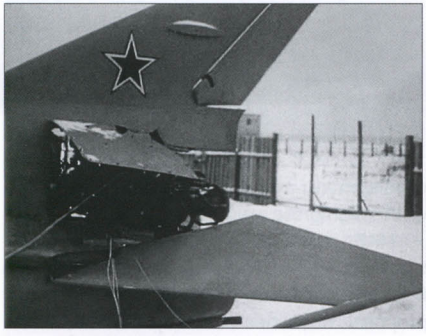
▲
Test pilot Valentin P. Vasin was also involved in testing the Ye-50.

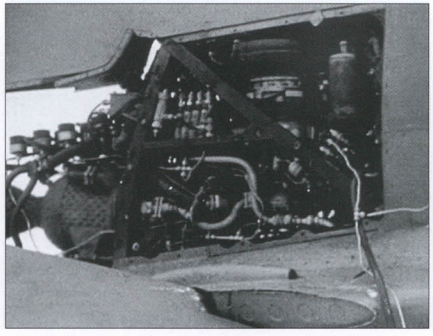
◄◄
For high-altitude missions in the Ye-50 the pilots wore the SI-3 pressure suit with a fishbowl-like full-face pressure helmet. Note the hermetically connected gloves and boots.

◄ ▲
Four views of the second prototype (Ye-50/2) at Zhukovskiy. Outwardly it differed from the Ye-50/1 in having an extra rod aerial below the cockpit.

km/h (1,118-1,242 mph), a service ceiling of 20,000-22,000 m (65,620-72,180 ft) and an endurance of 25-30 minutes, including at least five minutes on rocket motor power. The same directive tasked OKB-1 headed by Chief Designer Leonid S. Dushkin with developing a multiple-use liquid-fuel rocket motor rated at 4,000 kgp (8,820 lbst).

The Mikoyan OKB joined forces with TsAGI and LII to select the optimum layout of the future high-altitude interceptor and calculate its design parameters. The specialists of TsAGI and LII concluded that a single-engined fighter would be a better choice as a starting point than a twinjet aircraft such as the MiG-19. Because the





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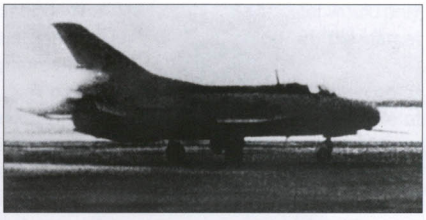
The rear end of the Ye-50 with the S-155 rocket booster uncowled.

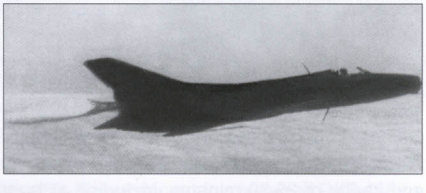
◄
This view of the S-155 rocket motor shows the A-shaped engine mount.

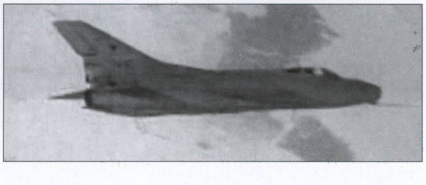
▶
Stills from a ciné film showing V. P. Vasin as he dons his pressure helmet and climbs into the cockpit of the Ye-50/2.

▶▶
The Ye-50/2 takes off with the rocket booster ignited.

The Ye-50/2 cruises with the rocket booster running; next, the rocket motor is shut down and the remainder of the rocket fuel components is jettisoned.
▶▶▼







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single-engined aircraft would be lighter, the rocket booster could enable it to exceed 2,000 km/h and reach an altitude of 25,000 m (82,020 ft). Such an aircraft could be armed with two 30-mm cannons, with provisions for replacing them with the K-5 air-to-air missiles then under development, and carry unguided rockets as well in high gross weight configuration.

MAP and the Air Force top command supported the idea of using a single-engined fighter as the basis. In October 1954 the proposal was considered by the Council of

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Ministers, which also supported the idea and tasked OKB-155 with developing two versions of the mixed-power fighter. The first of these, a technology demonstrator, was to enter flight test in July 1955 and be used for exploring the aircraft's stability and handling at high speeds and altitudes. The second version was a fully-fledged interceptor. Two prototypes differing in armament fit were to be manufactured; the first aircraft armed with two NR-30 cannons was to be ready for State acceptance trials in May 1956, while the other prototype was to feature K-5 AAMs and a fire control radar.

Design work on the new high-altitude interceptor, which received the in-house designation Ye-50, commenced in February 1954. The aircraft was based on the airframe of the Ye-2 swept-wing tactical fighter then under development. The changes concerned mostly the rear fuselage, which accommodated the rocket booster, and the fuel system. In November 1954 the OKB began issuing the manufacturing drawings to the prototype construction facility.

The Ye-50's fuselage structure included 37 frames and incorporated two ventral airbrakes. The Dushkin S-155 liquid-fuel rocket motor (the designation may indicate that it was specially designed for a Mikoyan aircraft – an OKB-155 product) was installed at the base of the fin, directly above the jetpipe of the cruise turbojet, delivering 3,800 kgp (8,380 lbst). It ran on TG-02 hypergolic kerosene (***top****livo ghipergo****lich****eskoye* – hypergolic, that is, self-igniting fuel) and AK-20 oxidiser (AK stood for *a****zot****naya kislo****ta*** – nitric acid); grade T hydrogen peroxide was used to work the turbo pump supplying the fuel and oxidiser to the rocket booster.

All rocket fuel components were accommodated in the fuselage; accommodating these corrosive substances safely alongside the tanks holding the TS-1 kerosene for the cruise engine proved to be a task of immense complexity. Therefore in December 1954 the Mikoyan OKB began designing a special test rig emulating the operation of the Ye-50's powerplant – the cruise turbojet, the rocket booster and their respective fuel system components. The rig was built by Vladimir M. Myasishchev's OKB-23 whose design office and experimental production facility were located at the LII airfield in Zhukovskiy. The specialists of LII and OKB-1 assisted the Mikoyan OKB in running the rig and verifying the interceptor's powerplant and fuel system. Flight tests of the S-155 were also undertaken by LII, using an Il'yushin IL-28R *Beagle* twin-turbojet tactical reconnaissance aircraft converted into an engine testbed (the rocket motor was installed in a conical fairing supplanting the IL-K6 tail turret).

Meanwhile, the prototype construction facility of OKB-155 was manufacturing the first

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V. P. Vasin climbs out of the Ye-50/2 after a successful test flight.

The Ye-50/2 about to become airborne, with the rocket booster belching a long sheet of flame.
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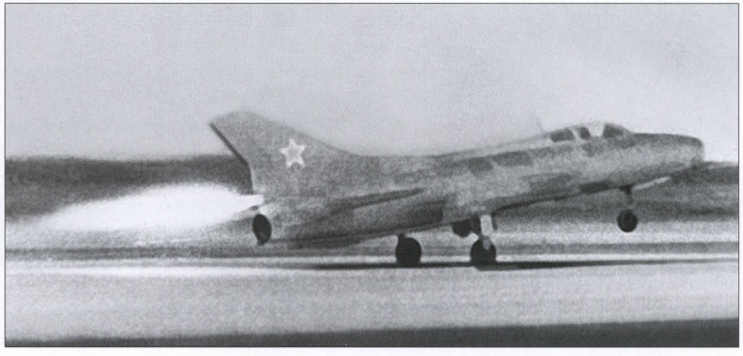

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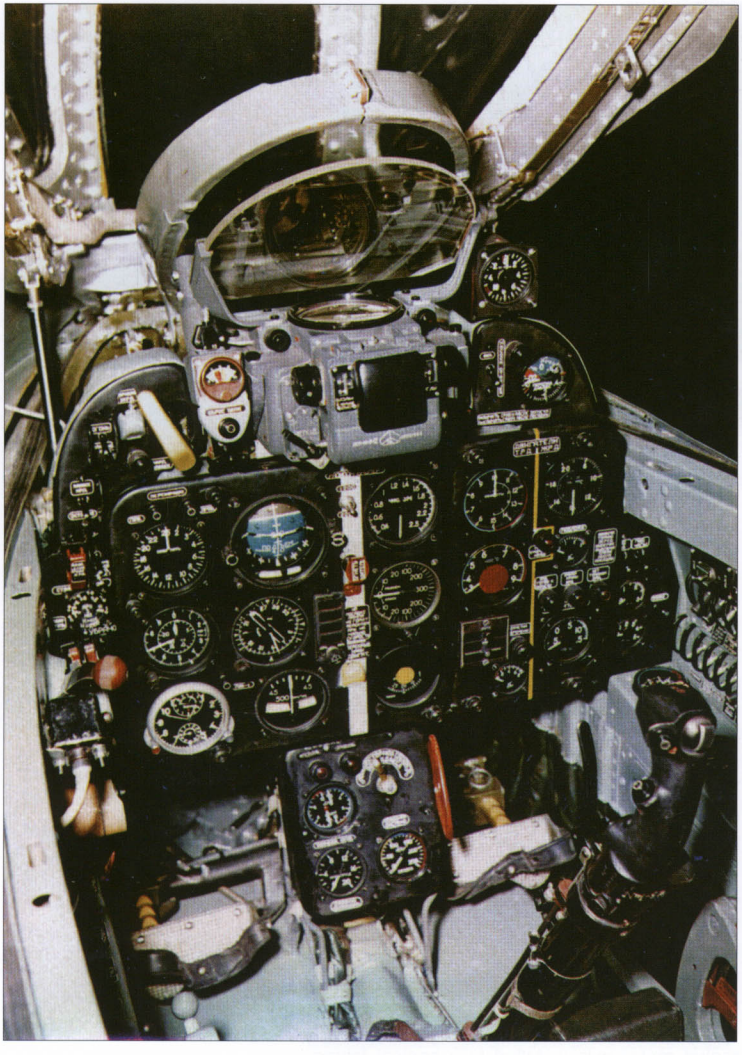

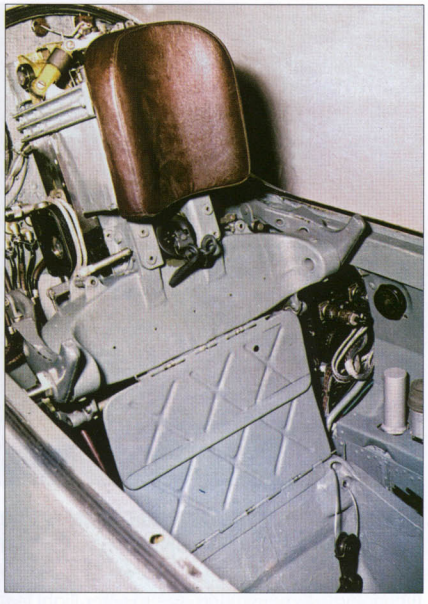

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▲ ▲ ► **The cockpit of the third prototype (Ye-50/3).**

prototype of the mixed-power fighter. Designated Ye-50/1, the machine differed from the basic Ye-2 in the following ways. The fuselage length was slightly increased, providing the internal space needed to accommodate the fuel and oxidiser for the rocket booster. This led to an increase of the landing gear wheelbase to 5.475 m (17 ft 11$^{3}/_{4}$ in).

The fuselage spine was redesigned, widening and growing in height downstream of the wing trailing edge to form a sort of fin fillet that blended smoothly into the rocket booster housing. A small cooling air scoop was added on the port side ahead of the kink in the spine's contour.

The bulged housing at the base of the vertical tail accommodated the S-155 rocket booster, its oxidiser tanks, turbo pump and rocket motor control system. It incorporated access panels, air scoops and a fairing for the rocket motor nozzle; the latter was level with the cruise turbojet's nozzle. Because of the booster installation the rudder was cropped at the base and the vertical tail trailing edge contour was altered, curving aft below the rudder.

Two long jettison pipes for the rocket fuel components ran along the rear fuselage underside, flanking the shallow ventral fin and extending beyond the cruise engine nozzle. Unlike the Ye-2A, special acid-proof alloys and coatings were used in the fuselage structure.

The Ye-50 had provisions for installing two NR-30 cannons. The first prototype, however, was unarmed and the cannon bays were occupied by test equipment.

The RD-9E cruise engine was a version of the RD-9B turbojet specially modified to expand its altitude and speed envelope; it delivered 3,300 kgp (7,275 lbst) in afterburner mode. The engine was attached to fuselage frames 21 and 25.

The flight controls were powered throughout, with a BU-27 irreversible hydraulic actuator working the rudder, a BU-44 actuator for the tailplanes and a BU-31 actuator (some documents say BU-45) for each aileron. The pneumatic system was modified to cater for the rocket booster, pressurising the latter's fuel and oxidiser tanks and operating the valves during start-up, in addition to its other functions.

The Ye-50's avionics included an RSIU-3M VHF radio, a Bariy-M IFF transponder, an ARK-5

ADF, an MRP-48P marker beacon receiver and an EDGMK-5 electric gyromagnetic compass (*elek**trich**eskiy distantsi**on**nyy **ghee**romag**nit**nyy **kom**pas*).

The life-support equipment included an SI-3 high-altitude pressure suit developed by OKB-918 under Chief Designer Guy Il'yich Severin; this establishment is now called NPP *Zvez**da*** ('Star'; NPP = *na**ooch**no-proiz**vod**stvennoye predpri**yah**tiye* – Research & Production Enterprise) and is Russia's chief manufacturer of crew rescue systems for aircraft. The suit came with a transparent pressure helmet incorporating an optically flat face panel to avoid distorting the pilot's view; the thing looked uncannily like a fishbowl. The aircraft retained the existing Yel3 ejection system with the canopy doubling as a slipstream shield during ejection.

Bearing no tactical code, the Ye-50/1 was completed on 4th November 1955 – just in time for 7th November, a major Soviet public holiday (the October Revolution anniversary). (Note: Unlike Western military aircraft, which have serial numbers allowing positive identification, since 1955 Soviet/Russian military aircraft usually have two-digit tactical codes which, as a rule, are simply the aircraft's number in the unit operating it, making positive identification impossible. Three-digit tactical codes are rare and are usually worn by development aircraft. On military transport aircraft, however, three-digit codes are usually the last three of the former civil registration; many Soviet/Russian Air Force transports were, and still are, quasi-civilian.)

After a two-month ground test cycle the first prototype made its maiden flight on 9th January 1956 at the hands of LII test pilot Valentin G. Mookhin. Originally N. V. Zaïtsev was the engineer in charge of the Ye-50's flight tests but he was soon succeeded in this capacity by Yu. N. Skorov. The Dushkin OKB assigned project engineer A. E. Zarin and section chief V. V. Pallo to the Ye-50's test programme.

The Ye-50's higher gross weight and rearward shift in CG position as compared to the Ye-2 made the aircraft harder to control – not only in flight but during taxiing as well. Mookhin pointed out that the fighter was reluctant to make turns during taxiing, especially on snow-covered taxiways, and recommended that the castoring nose gear unit be replaced with a hydraulically steerable one. With a full fuel load for both cruise engine and booster, the Ye-50's take-off run on turbojet power alone approached 3,000 m (9,840 ft); therefore, if the RD-9E failed to deliver full power in afterburner mode the pilot was faced with the choice of aborting the take-off or engaging the booster.

The Ye-50/3 featured a longer nose and a reshaped fairing above the rocket booster nozzle and a vertical rod aerial under the extreme nose. Note that only the starboard airbrake is open.
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▲ **This view of the Ye-50/3 shows the modified canopy with a reduced glazing area. The aircraft was painted grey overall.**

Early flight tests revealed that the Ye-50 had a few idiosyncrasies. At subsonic speeds between Mach 0.7 and Mach 0.98 the pilot experienced spontaneous thrusts of the rudder pedals, as if the rudder was doing its own thing ('the tail was wagging the dog'), and this phenomenon became increasingly manifest as the altitude increased. With the controls in manual mode (that is, with the hydraulic actuators switched off) the aircraft handled normally at indicated airspeeds (IAS) up to 550 km/h (341 mph/297 kts). Another unpleasant phenomenon that set in at speeds between Mach 0.7 and Mach 0.98 was the aircraft's tendency to drop a wing (*val'ozhka*), followed by a sharp jerk in the opposite direction. On the whole, however, the aircraft was stable enough and handled acceptably; rocket fuel burn-off did not have any serious effect on stability and handling.

In an attempt to get rid of the yawing and *val'ozhka* problems the designers fitted a bendable trim tab (called *nozh*, 'knife', in Russian) to the rudder trailing edge. The width of this tab was increased several times when it failed to produce the desired effect immediately; it was 50 mm (1 31/32 in) in the third flight and 75 mm (2 61/64 in) in the fourth one. Nevertheless, the yawing persisted, and after six flights the aircraft was grounded for further modifications; the test flights resumed on 25th May. Still, the problem was never cured completely.

The rocket booster's emergency fuel and oxidiser jettison system was put through its paces on 7th June; it turned out that the plume of fuel components trailing behind the aircraft did not ignite. On the following day V. G. Mookhin fired the rocket booster on take-off for the first time; the Ye-50/1 took just 11 seconds to become airborne with the booster running.

In the 12th flight Mookhin used the rocket booster in flight for the first time; the rocket motor delivered a thrust of 4,040 kgp (8,910 lbst) on that occasion. The booster was fired again in the 13th and 16th test flights; the rocket motor and its fuel system functioned flawlessly in minimum thrust mode and the rocket motor shut down automatically when the fuel ran out. The *modus operandi* was to ignite the booster at 6,600 m (21,650 ft) and put the machine into a 30° climb; the fighter reached a maximum altitude of 16,250 m (53,310 ft). After the 17th flight the Ye-50/1 was refitted with an RD-9E Series 4 cruise engine and the rocket booster's combustion chamber, which was approaching the limit of its service life, was replaced with a new one. Concurrently the original cockpit transparency was replaced by a heat-insulated metal canopy incorporating small circular windows (four to port and three to starboard); this made the cockpit a cooler place but impaired the pilot's field of view dramatically.

The 18th test flight took place on 14th July 1956. Part of the day's mission was to check out the new cruise engine; Mookhin was to take off at full military power and then engage the afterburner at 5,000 m (16,400 ft), climbing to 12,000-13,000 m (39,370-42,650 ft). He was also to assess the field of view afforded by the new canopy. As the Ye-50 lined up for take-off, the engine fire warning light illuminated suddenly; the pilot aborted the mission and taxied back to the hardstand. However, visual inspection of the engine did not reveal anything untoward, and engineer in charge Yu. N. Skorov gave the go-ahead for another try, instructing the pilot to abort the take-off, should he receive another fire warning.

As soon as the Ye-50 became airborne, however, things started to go wrong. The fire warning light started flickering again as the fighter climbed through 150-200 m (490-660 ft); the pilot throttled back but the light came fully on at 1,000-1,100 m (3,280-3,610 ft) and stayed on. Following his instructions, Mookhin radioed that he was aborting the mission and returning to base. The landing gear was extended as the aircraft turned off the base leg of the landing circuit, but the flaps were still up and the speed was too high. On final approach the speed had bled off to 420-430 km/h (260-267 mph; 227-232 kts) IAS. At an altitude of 400 m (1,320 ft), when it was between the inner and outer marker beacons, the aircraft suddenly stated losing altitude rapidly of its own accord. Mookhin tried revving up the engine in order to regain altitude, but the engine 'stuck' at low power and the aircraft undershot, touching down hard about 700 m (2,300 ft) short of the runway.

While the pilot was almost unscathed, the aircraft was much the worse for wear. The impact was so hard that the Ye-50/1 broke its back aft of the wings; the landing gear had collapsed and

the forward fuselage underside was crushed. The port wing broke at half-span and the flaps were severely damaged; the integral tanks were crushed and some of the bag-type tanks were damaged as well, and most of the equipment was wrecked.

The accident investigation panel headed by L. V. Chistyakov, chief of MAP's Flight Test Department, established that the engine's failure to respond to throttle inputs had been caused by a defective fuel control unit. The accident report also cited the inadequate field of view afforded by the modified cockpit canopy as a contributing cause for the accident.

At the time of the accident the first prototype had logged 5 hours 25 minutes' total time since new and the flight test programme was 42% complete. The Ye-50's mixed powerplant had functioned satisfactorily up to then, and generally the aircraft had given no major cause for complaint. Therefore on 25th August 1956 the Council of Ministers and the Communist Party Central Committee issued yet another joint directive (No. 1195-613) which not only required the flight tests of the Ye-50 to be continued but envisaged the production of a trial batch of Ye-50s at the Gor'kiy aircraft factory. It also tasked plant No. 154 with launching series production of the S-155 liquid-fuel rocket motor.

On 6th September 1956 MAP issued order No. 481 requiring the experimental plant No. 155 (the Mikoyan OKB) to rebuild the crashed first prototype to flying condition and build a second prototype of the Ye-50, commencing joint trials with the Air Force, using the two aircraft. This turned out to be impossible, as careful examination showed that the Ye-50/1 was a total loss; however, some bits and pieces could still be salvaged from the wreckage and used for the construction of further prototypes.

Construction of the second prototype (the Ye-50/2) began on 18th July 1956 and the aircraft was released by the factory on 7th December that year. Outwardly it differed from the ill-fated first prototype only in having a slightly reshaped fairing at the base of the fin and marginally greater rudder area and in being painted grey, not silver. Not so obvious was the fact that the Ye-50/2 had a new SK ejection seat and a revised canopy jettison system. The seat was designed in-house by V. M. Belyayev, S. N. Lyushin, A. R. Fokin, Mikhail R. Val'denberg, A. K. Yoodichev and K. A. Titkov.

Unlike the Yel3 ejection seat used hitherto on the type, the SK seat did not have a face blind that had to be pulled down to initiate ejection. Apart from that, the operating principle was the same – the canopy departed together with the seat, shielding the pilot from the slipstream. Although the seat was quite heavy, weighing up to 240 kg (530 lb), the ejection gun was powerful enough to impart an initial speed of 18.5-19 m/sec (60.7-62.3 ft/sec), briefly creating a G load of up to 20 Gs; if the ejection took place during deceleration from maximum speed, the G load could peak at 25-36 Gs. Thanks to the 'canopy protection' feature the SK seat permitted safe ejection at speeds up to 1,100 km/h (683 mph); the minimum safe ejection altitude was reduced from 250-300 m (820-980 ft) to 110 m (360 ft). To reduce the high G loads that could lead to spinal injuries during ejection, a long-stroke ejection gun was used and the actuating handles were located low on the sides of the seat, the pilot's arms being supported by special armrests during ejection.

Jumping ahead of our story, it should be noted that the SK ejection seat was fitted as standard to several versions of the future MiG-21.

With a 3,450-kg (7,605-lb) fuel load, the Ye-50/2 had a take-off weight of 8,472 kg (18,677 lb); the empty weight was 4,795 kg (10,570 lb). Again, the second prototype had provisions for two NR-30 cannons but none were actually installed. Valentin P. Vasin, a LII test pilot, was appointed project test pilot for this aircraft.

On 3rd January 1957 the Ye-50/2 made its maiden flight on turbojet power alone. The

One more view of the Ye-50/3, showing the shape of the stabilator root fairings. ▼

RSK MiG

rocket booster was ignited for the first time in the aircraft's third flight on 18th February, in which the second prototype accelerated to a maximum speed of 2,130 km/h (1,323 mph) in a climb, attaining an altitude of 23,600 m (77,430 ft). The aircraft remained fully controllable throughout and was able to manoeuvre and continue sustained level flight after the booster shut down automatically.

In the course of the manufacturer's flight tests the Ye-50/2 made 25 flights, 17 of which involved the use of the rocket booster. Usually the booster was fired in flight; on only one occasion was it ignited during the take-off run. The maximum speed attained was 2,470 km/h (1,534 mph) at 18,000 m (59,055 ft), which equals Mach 2.32; the maximum altitude attained in a zoom climb was 25,580 m (83,920 ft) with the booster ignited at 9,000 m (29,530 ft) and shut down at 23,000 m (75,460 ft), while the service ceiling in sustained level flight was 23,000 m. (Note: Some documents quote different figures for the Ye-50/2 – a top speed of 2,460 km/h (1,528 mph) at 18,500 m (60,695 ft) and a dynamic ceiling of 25,560 m (83,860 ft).)

At 20,000 m (65,620 ft) the aircraft could maintain level flight for four minutes (including deceleration time after booster shutdown). The Ye-50/2 climbed to 10,000 m (32,810 ft) in 6.7 minutes and to 20,000 m in 9.4 minutes. Endurance with the rocket booster running at full power was no more than 3.1 minutes, increasing to 16.2 minutes in low power mode. The landing speed was 250-260 km/h (155-161 mph); the Ye-50/2 had a take-off run of 2,000-3,000 m (6,560-9,840 ft) and a landing run of 1,100-1,300 m (3,690-4,265 ft).

In compliance with instructions from MAP's 7th Main Directorate, in August 1957 the Ye-50/2 was transferred to LII upon completion of the manufacturer's flight tests for further testing of the mixed powerplant. A while earlier, on 1st May (May Day, a major Soviet public holiday), test pilot Valentin P. Vasin had been awarded the prestigious Hero of the Soviet Union title for the successful testing of Mikoyan's high-altitude interceptor.

By July 1957 the second prototype had made 43 flights, the rocket booster was used in 20 of them. In late January 1958 LII test pilot Yuriy A. Garnayev flew a mission for the purpose of verifying the cockpit canopy jettison system. As the canopy was released at 1,500 m (4,920 ft), its rear end snagged the ejection seat headrest and then smashed through the transparency aft of the seat, damaging the aileron and tailplane control runs. Next, the wayward canopy struck the starboard wing, punching several holes in the skin, and narrowly missed the tail unit as it departed. Luckily, Garnayev was able to land the damaged fighter in one piece.

The third prototype (Ye-50/3) was laid down at the OKB's prototype construction facility in August 1956, almost concurrently with the Ye-50/2. Unlike the preceding two aircraft, which were unarmed and used as technology

The Ye-50/3 with the canopy open, showing the SK ejection seat.
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RSK MiG

demonstrators, the Ye-50/3 was completed as a fully capable interceptor fitted with the intended two NR-30 cannons and an ASP-5N computing gunsight. Assembly of the third prototype proceeded ahead of schedule, and by early 1957 the machine was 58% complete.

The Ye-50/3 differed substantially from the first two prototypes. Firstly, the fuselage nose was lengthened to provide room for additional avionics; the air intake was redesigned, featuring sharp lips and a two-shock centrebody of complex curvature. Secondly, the fuel system was altered to increase the cruise engine's fuel supply by 104 kg (229 lb) at the expense of the hydrogen peroxide supply for the turbo pump – one of the bag-type tanks in the rear fuselage gave place to a larger integral tank incorporating a PTsR-1 centrifugal transfer pump. This led to some revision of the rear fuselage and vertical tail structure – the contours of the fin in the area of the rocket booster were slightly altered.

Thirdly, the Ye-50/3 introduced a steerable nose gear unit replacing the earlier castoring nosewheel. Finally, changes were made to the avionics and equipment, including the flight instrumentation. In particular, the Ye-50/3 had more powerful communications equipment ensuring reliable air-to-ground communication at altitudes right up to 25,000 m (82,020 ft). Changes were made to the electric system, which now had more equipment to cater for. Like the second prototype, the Ye-50/3 was painted light grey overall.

The fighter was fitted with a new KKO-2M oxygen equipment set that had two operating modes. The long-term mode allowed up to ten hours of flight at altitudes up to 12,000 m (39,370 ft) if the cockpit decompressed or up to 24,000 m (78,740 ft) if the cockpit was pressurised. The short-term emergency mode allowed at least ten minutes of flight in the event of decompression at 12,000-20,000 m (39,370-65,620 ft) or up to four minutes' flight in the event of decompression at 24,000 m, allowing the pilot to begin an emergency descent. In the event of an ejection the oxygen supply switched automatically to the KP-27M breathing apparatus (*kislo**rod**nyy pri**bor***) housed in the ejection seat. The pilot of the Ye-50/3 wore a VKK-3M pressure suit and a GSh-4 full-face pressure helmet, both of which had electric heating for greater comfort at high altitudes.

The third prototype was cleared for manufacturer's flight tests on 17th April 1957. It had a 4,829-kg (10,646-lb) empty weight, which was an increase of 134 kg (295 lb) over the Ye-50/2; the take-off weight was 8,610 kg (18,980 lb), including 3,554 kg (7,835 lb) of fuel. The first flight took place on 21st May with LII test pilot Valentin P. Vasin at the controls. At first the tests went ahead successfully, and someone even suggested trying a real-life intercept of a Lockheed U-2 spyplane the next time it intruded into Soviet airspace. However, a mixed-power aircraft required special maintenance procedures and support infrastructure. Since Soviet Air Force bases lacked the ground support equipment necessary for handling the liquid-fuel rocket motor's corrosive fuel components, the idea of using the Ye-50 operationally was impracticable at the time.

MAP insisted that the third prototype be transferred to the State Red Banner Air Force Research Institute (GK NII VVS – *Gosoo**dar**stvennyy krasnozna**myon**nyy na**ooch**no-is**sle**dovatel'skiy insti**toot** Vo**yen**no-voz**doosh**nykh seel*) so that the military could make their acquaintance with the type. In anticipation of the State acceptance trials Lt. Col. N. A. Korovin, an Air Force test pilot, made several familiarisation flights in the aircraft; at least one of them involved the use of the rocket booster. The final pre-delivery flight marking the formal acceptance of the Ye-50/3 by GK NII VVS was scheduled for 8th August. However, on 7th August V. P. Vasin made another check-up flight in the aircraft – which turned out to be its last. The mission was to climb to 20,000 m (65,620 ft) with the booster running. Yet, in the course of the climb the Ye-50/3 suddenly became uncontrollable and flicked into a spin; all attempts to recover from it were to no avail and the pilot ejected.

The Ye-50/3 crashed and burned 100 km (62 miles) south-east of the LII airfield near the village of Radovitsy. Tragically, the search and rescue team found the pilot lying dead 150 m (490 ft) from the wreckage, still strapped into his seat.

The 'tin kickers' established that the rocket booster's turbo pump had exploded during the climb; the ensuing fire had partly consumed the vertical tail, rendering the aircraft uncontrollable and making spin recovery impossible. Upon ejection, the seat locks had malfunctioned and the cockpit canopy had not separated properly from the seat; therefore Vasin was unable to use his parachute. The crash occurred in the third prototype's 11th flight; six of the preceding ten flights had been performed with the rocket booster running.

The loss of the Ye-50/3 brought an end to the Ye-50 programme. It has to be said that the designers learned from their mistakes; it was this accident that prompted the Mikoyan OKB to start work on the new SK-3 ejection seat (alias KM-1)

which no longer used the cockpit canopy as a slipstream shield.

Ye-50A (MiG-23U) high-altitude interceptor (*izdeliye* 64)

As mentioned earlier, in the autumn of 1956 the Gor'kiy aircraft factory No. 21 began gearing up to build an initial production batch of mixed-power high-altitude interceptors pursuant to Council of Ministers/Communist Party Central Committee directive No. 1195-613 of 25th August 1956. The production plan for 1957 required the factory to complete 30 such aircraft and turn them over to the Air Force by mid-year. Since at that time the Gor'kiy aircraft factory was commencing low-rate initial production of the MiG-23 tactical fighter (Ye-2A, or *izdeliye* 63), it was decided that the mixed-power interceptor should be based on the MiG-23 in order to save time and simplify the production process. An important argument in favour of this decision was that the MiG-23 (Ye-2A) was powered by the R11-300 turbojet delivering more thrust than the RD-9E fitted to the Ye-50 and thus providing higher performance.

Hence by the end of October 1956 the Mikoyan OKB had reworked the Ye-50 project, taking the Ye-2A as the starting point. Bearing the manufacturer's designation Ye-50A, the new version had a suitably modified R11E-300 cruise engine with an afterburner rating of 5,100 kgp (11,240 lbst). At the Gor'kiy factory the aircraft was known by the service designation MiG-23U (the U suffix denoted *ooskorite*l' – booster) and the product code *izdeliye* 64.

According to the advanced devlopment project the Ye-50A was to climb to 12,000 m in full afterburner (that is, on turbojet power only) and then engage the S-155 rocket booster. It was estimated that the interceptor would reach its design service ceiling of 27,000 m (88,580 ft) in no more than 5.62 minutes. The design maximum speed was 2,480 km/h (1,541 mph) at 15,000 m (49,210 ft).

As compared to the predecessor, the Ye-50A incorporated a host of changes aimed at improving the mixed powerplant's reliability and at making the rocket booster more maintenance-friendly. The wings, horizontal tail, landing gear and cockpit canopy were borrowed from the Ye-2A in as-was condition. The Ye-50A differed from the Ye-50 prototypes in the following ways:

• the S-155 rocket motor and the hydrogen peroxide tank for the turbo pump were buried inside the base of the fin;

• the Nos. 6 and 7 fuselage fuel tanks (that is, as per the standard Ye-2A's fuel system) were deleted, restricting the supply of TS-1 kerosene for the cruise engine to 1,160 kg (2,560 lb) in five fuselage tanks;

• part of the rocket booster's fuel system (the tanks holding the AK-20 nitric acid oxidiser and part of the TG-02 hypergolic kerosene) was housed in a detachable conformal pod under the fuselage which also accommodated the rocket motor controls. The remainder of the TG-02 fuel was housed inside the fuselage in a tank supplanting the former Nos. 6 and 7 fuel tanks of the cruise engine's fuel system, and the overall capacity remained unchanged;

• due to the smaller number of fuel tanks in the fuselage the rocket booster's fuel feed and control systems were revised, featuring fewer components;

• an extra frame was introduced in the rear fuselage structure;

• an air ejector was installed to provide an air flow through the engine bay;

• because of the higher take-off weight and the higher unstick speed the main landing gear units were fitted with new KT-27 wheels equipped with twin brakes (the nose gear unit still had a KT-38 wheel, also with twin brakes);

• the flight control system was altered – the control runs inside the fuselage were identical to those of the Ye-2A up to frame 20 and to those of the Ye-50 further downstream.

The Ye-50A's take-off weight increased to 9,300 kg (20,500 lb) and the fuel load to 3,955 kg (8,720 lb). According to the project the weight of the rocket booster's fuel components totalled 2,795 kg (6,160 lb), including 2,060 kg (4,540 lb) of AK-20 oxidiser, 625 kg (1,377 lb) of TG-02 fuel and 110 kg (242 lb) of hydrogen peroxide. The booster's fuel consumption was estimated at 18.1 kg/sec (39.9 lb/sec).

The Ye-50A's basic avionics and equipment included a *Gori**zont**-1V* (Horizon) ground controlled intercept (GCI) system receiver, an RSIU-3 VHF radio (some late documents quote a different model, the RSIU-4VMG), an ARK-5 ADF, an MRP-48P marker beacon receiver (late documents quote the MRP-56P), an SRO-2 Khrom IFF transponder, an SOD-57M Globus-2 (Globe) decimetre-waveband active ATC transponder and a GIK-1 gyro flux-gate compass (***ghee**roindooktsi**on**nyy kompas*). The cannons were aimed by means of an ASP-5N computing gunsight (late documents quote the ASP-5NV-IV version; the 'IV' is a Roman numeral) linked to an SRD-1M radar rangefinder, which by then had been renamed from Radal'-M to ***Kon**us* (Cone) – presumably because it was now located inside the air intake shock cone (which was now partly

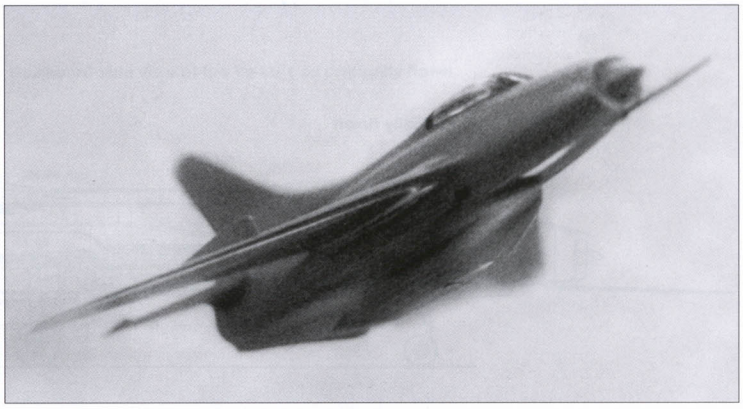
dielectric) instead of a strake on top of the nose, as on the Ye-2 and Ye-50. Plans were in hand to install the *Yu**pit**er-2* (Jupiter) infrared search & track (IRST) unit that would enable stealthy attacks without revealing the interceptor by switching on the radar.

The Ye-50A was armed with two 30-mm NR-30 cannons equipped with muzzle brakes, with 60 rpg. Provisions were made for carrying two ORO-57K eight-tube rocket pods loaded with 57-mm (2.24-in) ARS-57 or ARS-57K FFARs under the wings; the unguided rockets were likewise to be used against aerial targets.

By the end of 1956 the Mikoyan OKB had issued a complete set of manufacturing documents for the Ye-50A to the Gor'kiy aircraft factory. Concurrently, in keeping with an order signed by the PVO Commander on 12th November 1956, the PVO's fighter units began preparing for the service introduction of two mixed-power interceptors – the MiG-23 (Ye-50A) and the twin-turbojet Yak-27V developed by Aleksandr S. Yakovlev's OKB-115. The former type was to enter service with two units of the Moscow Air Defence District – the 594th UIAP (*oo**cheb**nyy istre**bit**el'nyy **avia**polk* – instructional fighter regiment) at Savasleyka airbase near Gor'kiy and the 23rd IAP stationed in Rzhev.

However, the production plans were foiled by the lack of R11E-300 engines – the production entry of this turbojet was beset by immense problems. The revised plan for 1957 envisaged the production of twelve MiG-23Us instead of the 30 specified originally; ten of these aircraft were to be delivered to the PVO's fighter arm, while the remaining two were to be used for check-up trials at GK NII VVS. Yet, even this downsized plan went down the drain – in 1957 the Gor'kiy aircraft factory was able to complete just a single MiG-23U due to the continued unavailability of production R11E-300 turbojets. The first production example was rolled out and accepted by the Air Force's quality control inspector at the plant in the autumn of 1957; at that time two more MiG-23Us (Ye-50As) were in the assembly jigs and a further eight shipsets of airframe components were awaiting assembly.

At the end of December 1957 two dismantled Ye-50As were delivered to the Mikoyan OKB's prototype manufacturing facility in Moscow.



Yefim Gordon archive

▲
A rather crude desktop model of the projected Ye-50A. Note the large twin ventral fins flanking the rear end of the conformal fuel/oxidiser pod.

Ye-50P high-altitude interceptor (project)

In early March 1958 the elusive U-2 reconnaissance aircraft again put in an appearance, intruding into Soviet airspace over the Far East – and again with impunity because the Soviet PVO still had nothing to oppose it with. The Mikoyan OKB suggested that the still-unfinished production Ye-50A (MiG-23U) interceptors should be completed with new armament consisting of K-5 air-to-air missiles instead of NR-30 cannons. Accordingly the

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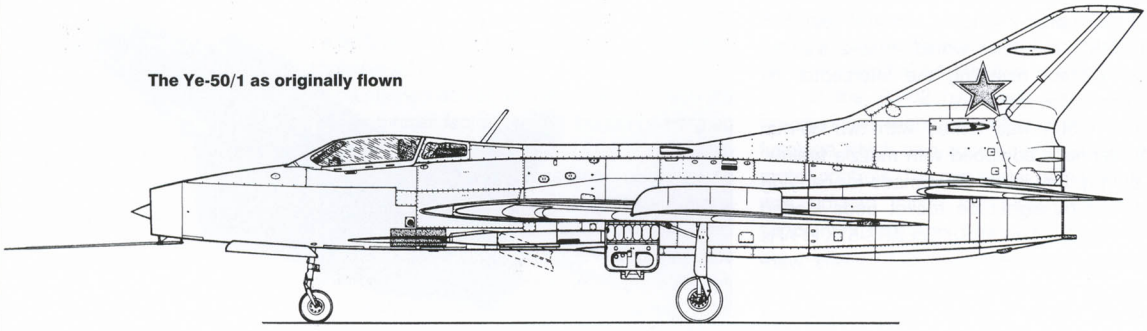
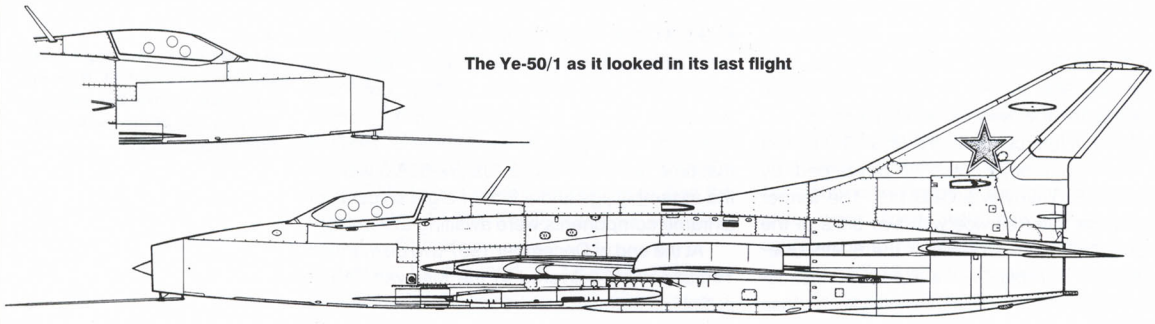
An artist's impression of the Ye-50A from the project documents. Here the ventral strakes are very shallow – and, unusually, there are no wing fences.

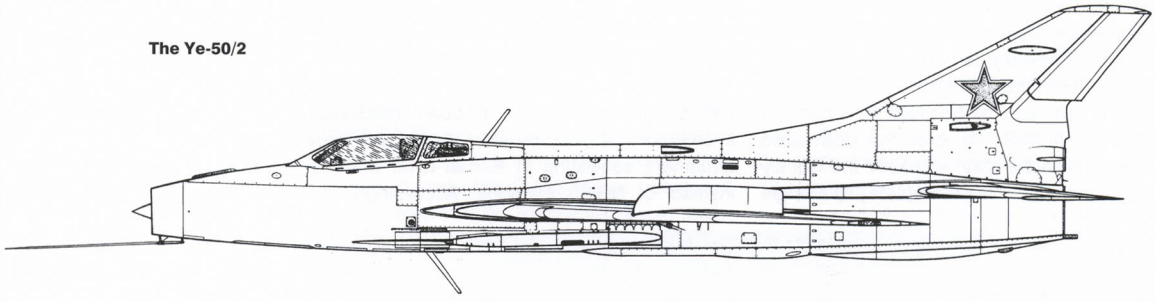
The Ye-50/1 as originally flown



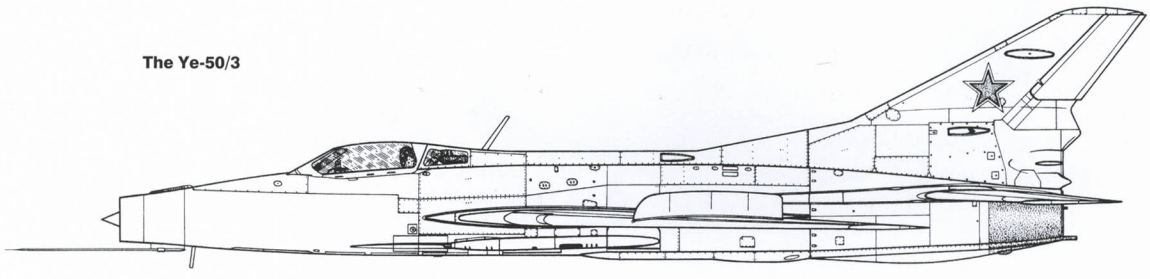
The Ye-50/1 as it looked in its last flight



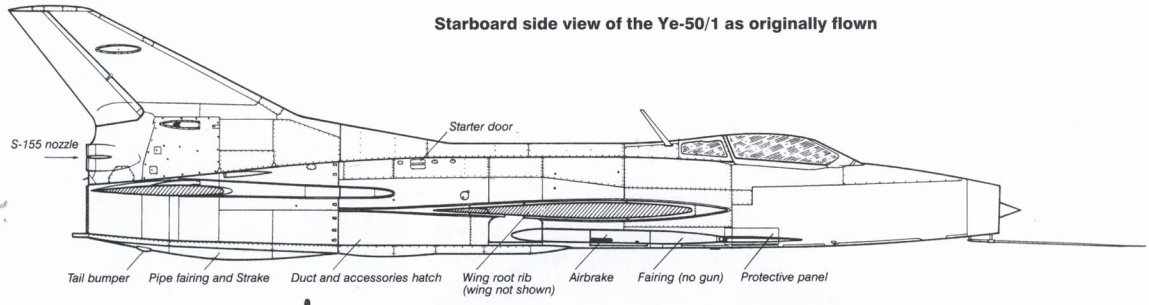
The Ye-50/2

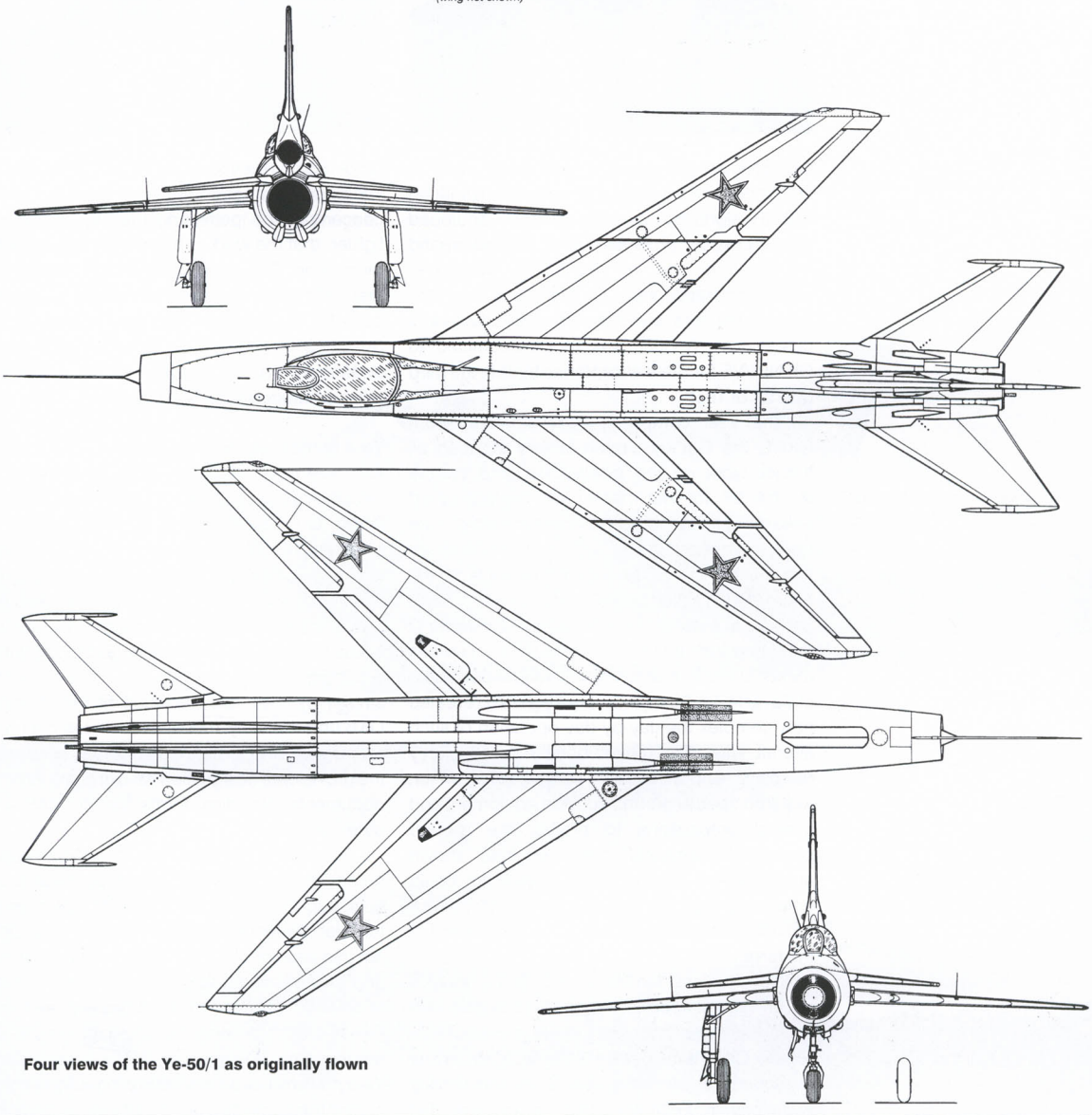


The Ye-50/3



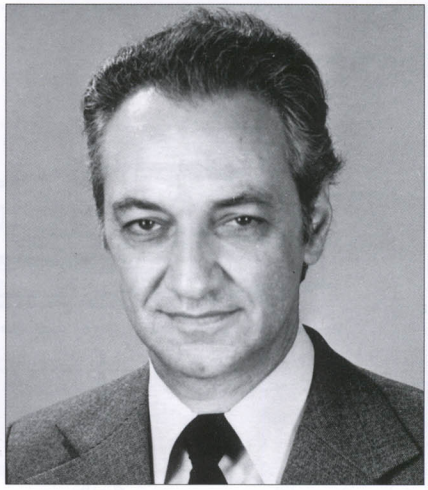
Starboard side view of the Ye-50/1 as originally flown





Four views of the Ye-50/1 as originally flown

▶ **A. G. Broonov was the MiG-21's project chief for many years.**



▶▶ **V. A. Mikoyan, the engineer in charge of the Ye-4's tests.**

RSK MiG

ASP-5N gunsight would be replaced by a TsD-30 fire control radar working in conjunction with an ASP-51 sight; the aircraft would be equipped with a *La**zoor'*** (Prussian Blue) GCI command link system and an SOD-57M decimetre-waveband transponder. In this guise the interceptor, which received the new manufacturer's designation Ye-50P, was to be submitted to GK NII VVS for State acceptance trials in the third quarter of 1958.

That year, complying with instructions from GKAT, the Gor'kiy aircraft factory stopped all further work on the *izdeliye* 64 (and on the *izdeliye* 63, for that matter) and the unfinished airframes sitting in the final assembly shop were never completed. There was ample reason for this. Firstly, the State acceptance trials of the MiG-19SU mixed-power interceptor (alias SM-50, a version of the MiG-19S *Farmer-C* equipped with a U-19 single-impulse liquid-fuel rocket booster in a conformal ventral pod) held at Savasleyka AB in February 1958 had revealed how complex the day-by-day operation of such aircraft was. The rocket booster used highly corrosive and toxic fuel components, which required special ground support equipment and special precautions to protect the ground personnel. Secondly, the trials had shown unsatisfactory results, as the interceptor could only remain at high altitudes very briefly, which did not guarantee detection and engagement of the target.

Nevertheless, the Mikoyan OKB did not give up on high-altitude interceptors equipped with liquid-fuel rocket boosters just yet. It was not until GKAT Chairman Pyotr V. Dement'yev wrote to Council of Ministers Vice-Chairman Dmitriy F. Ustinov in February 1959, suggesting that OKB-155 be relieved of the Ye-50A high-altitude interceptor programme so that it could concentrate on perfecting the MiG-21 tactical fighter, that the work in this direction was finally terminated. This was a logical move, considering that SAM systems appeared to have far greater potential against high-flying targets and that the Soviet Air Force's tactical arm (FA – *Fronto**va**ya avi**ah**tsiya*) was in urgent need of a modern mass-produced supersonic fighter.

Ye-4 tactical fighter prototype

As mentioned earlier, in 1953 the Ministry of Aircraft Industry tasked two of its subdivisions, Pavel O. Sukhoi's OKB-51 and Artyom I. Mikoyan's OKB-155, with developing, building and testing new tactical fighters featuring both thin swept wings and delta wings. The Mikoyan OKB's delta-wing fighter initially bore the in-house designation I-500 (the I stood for *istre**bite**l'* – fighter; this pre-war practice of designating aircraft by their role persisted at the Mikoyan OKB until the early 1950s). Later the aircraft was redesignated Ye-5, although one may encounter the provisional designation Kh-5 in some internal documents, statistical forms filed to MAP and other paperwork.

Pursuant to the Council of Ministers directive dated 9th September 1953 the fighter was to be designed around the Mikulin AM-11 afterburning turbojet. As mentioned earlier, the Mikulin OKB ran into development problems with this engine, and the timeline for the delivery of flight-cleared engines for Mikoyan's prototypes kept slipping. Hence OKB-155 took the decision to build an aerodynamic analogue or demonstrator of the Ye-5 powered by an available production engine so that the properties of the delta wings could be

explored. This proof-of-concept aircraft was designated Ye-4.

The Ye-4 shared the airframe of the future Ye-5. The fuselage and tail surfaces were identical to those of the Ye-2, which was under development at the same time. The difference lay in the wings, which were of pure delta planform with 57° leading-edge sweep. To simplify the design process the mainwheel wells in the fuselage accommodating the wheels were left unchanged; however, the main gear oleos and the recesses in the wings accommodating them had to be adapted to the new wing structure, which led to a change in the wheel track. The wings utilised a TsAGI S9S airfoil with a thickness/chord ratio of 4.5%. The tapered ailerons were aerodynamically balanced; as per project they had a travel limit of ±25°, but on the actual aircraft this was reduced to ±16°. The slotted flaps had constant chord. Each wing carried a single large boundary layer fence on the underside just outboard of the main gear fulcrum.

The fuselage incorporated two ventral airbrakes located symmetrically below the wing leading edge and having an elongated shape. The fuel system comprised four groups of tanks in the fuselage holding a total of 1,570 litres (345.4 Imp gal); additionally, a 400-litre (88 Imp gal) drop tank with a pointed nose optimised for supersonic speeds could be carried on a centreline pylon.

The armament consisted of three NR-30 cannons with 60 rpg buried in the forward fuselage underside – one to port and two to starboard, just like on the Ye-2. The cannons were belt-fed; spent cases were ejected, while belt links were collected in the magazines. Also, the Ye-4 could carry a single 500-kg (1,102-lb) FAB-500 HE bomb or a 16-tube rocket pod loaded with 57-mm (2.24-in) ARS-57 FFARs on the centreline pylon.

The pitch and roll control circuits included irreversible hydraulic actuators – a BU-44 actuator for the stabilators and a BU-45 actuator for the ailerons. The pitch control circuit also

The one-off Ye-4 prototype, showing the short nose, high-set tailplanes, ventral wing fences and twin ventral fins.
▼

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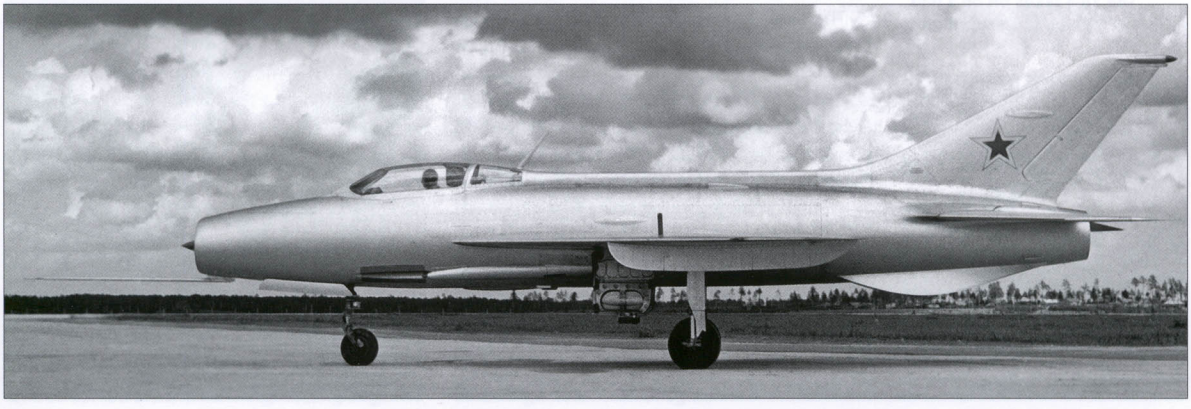

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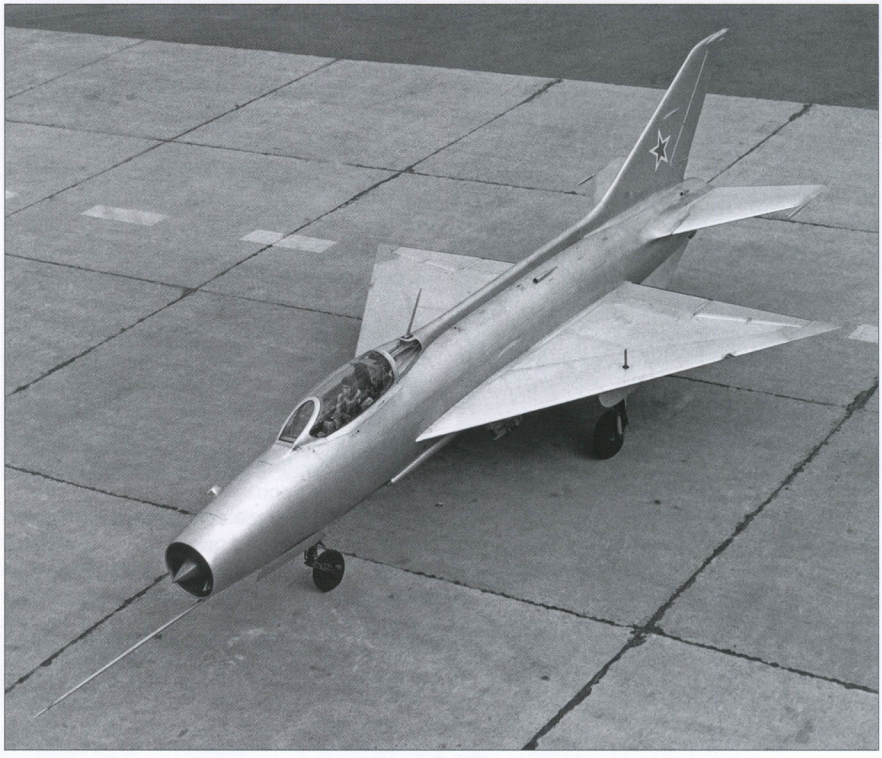

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This view illustrates well the Ye-4's original pure-delta wing planform. Note the IFF rod aerial on top of the port wing. Note also the lack of the strake-like radar rangefinder aerial (the antenna is housed inside the dielectric intake centrebody).

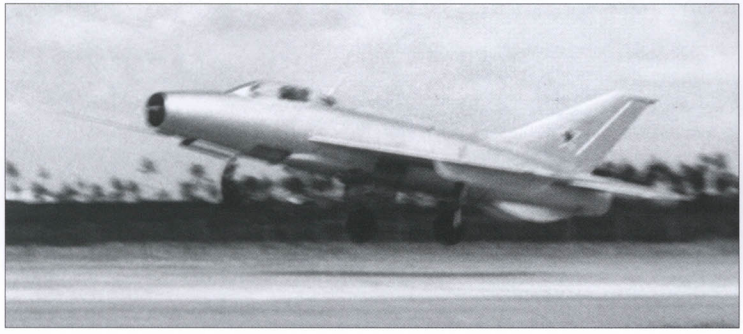
featured an ARU-3V automatic flight control governor (*avto**maht** regoo**lee**rovaniya oopravleniya*) adjusting stick-to-tailplane gearing and stick forces, depending on the speed and altitude.

The Ye-4 had the same Mikoyan KK-2 ejection seat as fitted to the MiG-19; the seat featured a telescopic ejection gun, footrests with leg restraints and a visor protecting the pilot's face. Ejection was accomplished by pulling this visor (which was normally stowed in the seat headrest) down with both hands; thus the visor doubled as an arm restraint.

The avionics suite included an RSIU-4V VHF radio, an ARK-5 ADF and a Sirena-2 RWR. Weapons aiming was done by means of an ASP-5N computing gunsight linked to an SRD-1M Konus radar rangefinder.

The Ye-4 had an overall length of 13.23 m (43 ft 4⁵⁵⁄₆₄ in) less pitot and a fuselage length of 11.737 m (38 ft 6⁵⁄₆₄ in), standing 4.028 m (13 ft

The Ye-4 takes off on a test flight.



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2$^{37}/_{64}$ in) tall when parked. The wing span was 7.754 m (25 ft 5$^{1}/_{2}$ in) and the horizontal tail span 3.726 m (12 ft 2$^{45}/_{64}$ in); the wing area was 23.13 m^2 (248.7 sq ft). The landing gear wheel track was 2.692 m (8 ft 9 63/64 in) and the wheelbase 4.48 m (14 ft 8$^{3}/_{8}$ in).

As originally completed, the Ye-4 had a Mikulin AM-5 non-afterburning turbojet rated at just 2,000 kgp (4,410 lbst) for take-off; available documents fail to provide a plausible reason why such a low-powered engine was chosen. In this guise the aircraft was delivered to the Mikoyan OKB's flight test facility in Zhukovskiy in June 1955. After the obligatory weigh-in, ground checks, taxi runs and short hops the Ye-4 made its maiden flight on 16th June with Mikoyan OKB chief test pilot Gheorgiy A. Sedov at the controls. Being designed with a much bigger engine in mind, of course the Ye-4 could not demonstrate high performance with its initial stop-gap powerplant: the top speed was an unimpressive 1,296 km/h (805 mph), the service ceiling 16,400 m (53,805 ft); the fighter climbed to 5,000 m (16,400 ft) in 1.6 minutes and had a range of 1,120 km (695 miles).

Since the intended RD-11 turbojet was still unavailable, as the next-best thing the Mikoyan OKB revised the Ye-4 project to take the RD-9E afterburning turbojet delivering 3,300 kgp (7,275 lbst). Additionally, the results of the initial flight tests, which were anything but satisfactory, led the specialists at TsAGI to recommend that certain changes be made to the Ye-4's structure and aerodynamics.

The Mikoyan OKB wasted no time upgrading the Ye-4. Modification work began in late 1955, and by the spring of 1956 the aircraft was a lot different from the configuration in which it was first flown. First and foremost, the aircraft was refitted with an RD-9I turbojet.

Major changes were made to the aerodynamics. Aileron area was reduced by shortening the ailerons 250 mm (9$^{27}/_{32}$ in) at the outer ends; to compensate for this the aileron travel limits were increased from ±16° to ±20°. In order to improve the aircraft's stability during G load changes in subsonic flight the stabilator dihedral was increased by introducing a new curved axle to which the stabilators were attached. Measures were taken to improve the wing aerodynamics at high angles of attack in transonic flight – small kinked leading-edge root extensions were added, the single large boundary layer fences on the wing underside were deleted and three smaller fences were fitted on the upper surface of each wing. The inboard and centre fences curved around the wing leading edge.

Boris Vdovenko

◄ ▼
The Ye-4 seen during a rehearsal flight.

A while earlier, in the course of the manufacturer's flight tests, the Ye-4's wing planform was changed from pure delta to cropped delta by lopping off 300 mm (11$^{13}/_{16}$ in) of wing on each side. According to V. A. Mikoyan (the engineer in charge of the tests), he personally took a hacksaw and sliced off the wingtips, following the aerodynamicists' recommendations.

According to the Mikoyan OKB's 1956 Technical report, the Ye-4's fuel system comprised five tanks with a total capacity of 1,100 litres (242 Imp gal) – four bag-type tanks in the centre fuselage and one integral tank in the detachable rear fuselage. A 400-litre (88 Imp gal) drop tank could be carried. The same document lists the fighter's avionics as follows: a Klyon (Maple) radio, an ARK-5 ADF, an ASP-5N gunsight working in conjunction with an [SRD-3] Grad (Hail) radar rangefinder, a Siren'2 RWR, an MRP-48P marker beacon receiver and a Bariy-M IFF transponder. The latter's rod aerial was located on the port wing upper surface between the centre and outer boundary layer fences.

On 26th July 1956 the modified Ye-4 was among the development aircraft participating in the traditional Tushino flypast; the machine was flown by Mikoyan OKB test pilot Vladimir A. Nefyodov at the event. The manufacturer's flight tests were completed on 20th September 1956, involving a total of 109 flights.

RSK MiG

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As part of the Ye-5's development programme, the Ye-4 was used in a special test programme to explore the spin characteristics of a delta-wing fighter and its aerodynamics at speeds up to Mach 1.45. The Ye-4 was also used to determine the minimum control speed, the aerodynamic forces applied to the cockpit canopy, the position of the aircraft's focal point with the flaps set 5° and other aerodynamic parameters. The tests provided a comparison of the airflow patterns on the old pure-delta wings with single ventral wing fences and the new cropped-delta wings with triple dorsal wing fences.

Upon completion of the manufacturer's tests the sole Ye-4 was transferred to LII. The institute used this aircraft for high-alpha research.

Ye-5 (Kh-5, I-500, MiG-21) tactical fighter prototypes (*izdeliye* 65)

The aforementioned Council of Ministers directive No. 2380-975 of 9th September 1953 and MAP order No. 31 of 11th September 1953 required OKB-155 to design and build a single-seat tactical fighter with delta wings powered by a Mikulin AM-11 turbojet in parallel with the Ye-2.

The ADP of the new delta-wing supersonic tactical fighter was completed in the summer of 1954 and endorsed by Chief Designer Artyom I. Mikoyan on 26th June. As mentioned earlier, initially the machine was known as the I-500 but

▲▲▲ **The Ye-4 in revised form with clipped wingtips and triple dorsal wing fences. The small nozzle of the RD-9I engine is evident.**

RSK MiG

▶ **Note how the inboard and centre pairs of fences curve around the wing leading edge on the modified Ye-4.**

was soon redesignated Ye-5, although some early documents referred to it as the Kh-5. According to the project, the aircraft's normal take-off weight was to be 5,200 kg (11,460 lb), rising to 5,900 kg (13,010 lb) in maximum take-off weight configuration with a drop tank; the empty weight was 3,506 kg (7,729 lb). The internal fuel load amounted to 1,400 kg (3,090 lb); fitting a drop tank increased it to 2,030 kg (4,475 lb).

The fighter was armed with a trio of 30-mm (1.18 calibre) Nudelman N-30 (*izdeliye* 235P) cannons developed by OKB-16 in Tula, with 60 rpg. Alternative air-to-ground weapons carried on the centreline pylon were a single 250-kg (551-lb) FAB-250 HE bomb; or two eight-round rocket pods with 57-mm (2.24-in) ARS-57 FFARs side by side on a special adapter; or two 190-mm (7.48-in) TRS-190 rockets in paired ORO-190 launch tubes (*odi**noch**noye reak**tiv**noye o**roo**diye* – lit. single jet gun') with shortened barrels; or a single 212-mm (8.34-in) ARS-212 rocket.

Given the AM-11's advertised afterburner rating of 5,000 kgp (11,020 lbst), the Ye-5 was expected to have a take-off run of no more than 365 m (1,200 ft), becoming airborne in 11.1 seconds; the landing run was not to exceed 700 m (2,300 ft). The cockpit featured a 10-mm (0$^{25}/_{64}$ in) forward armour shield, an 18-mm (0$^{45}/_{64}$ in) bulletproof windscreen integrated into the one-piece forward-hinged canopy and an additional fixed 64-mm (2$^{33}/_{64}$ in) laminated bulletproof glass screen inside the canopy. From behind the pilot was protected by a rear armour shield and an armoured headrest, both 16 mm (0$^{5}/_{8}$ in) thick, and an extra 6-mm (0$^{15}/_{64}$ in) armour plate. The total weight of the cockpit armour was 79 kg (174 lb).

The first prototype designated Ye-5/1 was built in 1955, becoming the second Mikoyan development aircraft with delta wings after the Ye-4 (which, as recounted earlier, was a stop-gap programme undertaken because the State acceptance trials commencement deadline was drawing close and the behaviour of delta-wing aircraft was still unexplored). Like its Ye-2 and Ye-4 stablemates, the actual Ye-5 was armed with three NR-30s (rather than N-30s as per the ADP) located in the same fashion – one to port and two to starboard; the Nudelman/Rikhter version of the weapon had the same product code (*izdeliye* 235P).

Apart from the powerplant, the Ye-5 differed from the Ye-4 in the following respects. Two independent hydraulic systems were provided, one of which catered exclusively for the control system actuators, and an extra PN-34 engine-driven hydraulic pump was installed; the hydraulic systems had a nominal pressure of 210 kg/cm^2 (3,000 psi). The rear fuselage featured air ejectors providing a cooling air flow through the engine bay; the ejector air intakes were built into the stabilator root fairings. On the ground the ejector used bleed air from the last compressor stage; in flight the engine bay was cooled by ram air. The engine itself had no air ejector and the nozzle petals were exposed.

The Ye-4 tended to pitch down when the forward-mounted airbrakes were deployed. To eliminate this tendency and make the fighter easier to fly, the Ye-5/1 introduced a third,

RSK MIG

▲
The first prototype Ye-5 fighter (Ye-5/1) shows off the pure-delta wings with triple wing fences and the engine bay cooling air intakes built into the stabilator root fairings.

RSK MiG

RSK MiG

RSK MiG

▲ **More aspects of the Ye-5/1, showing the fatter rear fuselage accommodating the AM-11 engine. Again, the fighter had twin ventral fins and small mainwheels.**

perforated airbrake located in a bulge on the centreline near the wing trailing edge. The forward airbrakes had a total area of 0.8 m² (8.61 sq ft) and were deflected 40°, while the rear one had an area of 0.47 m² (5.06 sq ft) and a 25° deflection angle.

The fuselage was of oval cross-section with the larger axis vertical and the fuselage structure included 36 frames. The forward airbrakes were located between frames 11-14, while the rear airbrake was located between frames 22-23. The longitudinal structural members of the fuselage included five longerons and a number of extruded stringers; three longerons absorbed the bending loads and the other two absorbed the vertical forces. As in the case of the Ye-2, thick skin panels were used on the centre fuselage between frames 13-28 in order to minimise the use of riveting. The wing ribs were stamped from sheet metal. The wingtip fairings, aileron trailing edge sections and some other airframe components had a foam filler.

The supersonic air intake had a two-position centrebody (shock cone) controlled by a hydraulic actuator. At low speeds the centrebody was in the aft position, moving into

The dimensions of the Ye-5

Length less pitot boom	13.23 m (43 ft 4⁵⁄₆₄ in)
Length including pitot boom	15.545 m (51 ft 0 in)
Fuselage length	11.33 m (37 ft 2¹⁄₁₆ in)
Height on ground	4.028 m (13 ft 2³⁷⁄₆₄ in)
Wing span	7.754 m (25 ft 5⁵⁄₃₂ in)
Wing area	23.13 m² (248.7 sq ft)
Stabilator span	3.726 m (12 ft 2⁴⁵⁄₆₄ in)
Stabilator area	4.074 m² (43.85 sq ft)
Landing gear wheel track	2.692 m (8 ft 9⁶³⁄₆₄ in)
Landing gear wheelbase	4.48 m (14 ft 8⅜ in) *
Stabilator deflection limits	7°30' up/16°30' down
Aileron deflection limits	±20°
Rudder deflection limits	±25º
Maximum flap deflection	24º30'

* measurements made before the manufacturer's flight tests showed 4.41 m (14 ft 5⅜ in)

RSK MiG

▶ **As this view shows, the outer wing fences of the Ye-5 cut the star insignia in half, making them invisible from certain angles. Again, the IFF rod aerial is located on top of the port wing.**

RSK MIG

▲
Side view of the Ye-5/1; the fighter sat high above the ground on its stalky landing gear.

the forward position automatically when the aircraft accelerated to Mach 1.4.

Again, the wings had 57° leading-edge sweep and utilised a TsAGI S9S airfoil; the thickness/chord ratio was 4.2% at the roots and 5% at the tips. The wings were equipped with aerodynamically balanced ailerons and slotted flaps. The stabilators swept back 55° at quarter-chord used a NACA-M airfoil with a thickness/chord ratio of 6%, while the vertical tail had 60° sweepback at quarter-chord and a TsAGI S11S airfoil – again with a thickness/chord ratio of 6%.

Like its immediate precursor, the Ye-5 had KT-27 mainwheels with twin brakes. The steerable nose gear unit had a KT-38 wheel with twin brakes.

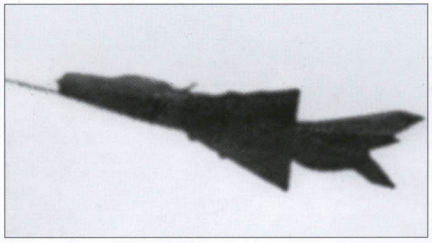
Electric power was supplied by a 9-kilowatt GSR-ST-9000A generator and, initially, a single 15 A·h 12SAM-15 lead-acid battery installed as per project. The basic avionics included an RSIU-4V VHF radio, an SRO-2 Khrom IFF transponder, an ARK-5ADF, an MRP-48P marker beacon receiver, a Sirena-2 RWR and an ASP-5N-V3 computing gunsight linked to an SRD-1M Konus radar rangefinder. The aircraft was fitted with a KKO-1 oxygen equipment set.

The RD-11 powered Ye-5/1 was completed by the OKB's prototype construction facility at the end of 1955 and arrived at the OKB's flight test facility in Zhukovskiy on 10th December. The aircraft had been built in almost complete conformity with the project documents, with only minor changes in the equipment; in particular, a 12SAM-28 DC battery of greater capacity (28 A.h) had been fitted temporarily, with the intention to replace it eventually with a 45 A.h 15STsS-45 silver-zinc battery.

The ground test and preparation phase lasted from 11th December 1955 to 8th January 1956. A team consisting of engineer in charge V. A. Mikoyan, laboratory chief Konstantin K. Vasil'chenko, flight test facility chief K. P. Kovalevskiy and test pilot Vladimir A. Nefyodov was assigned to the aircraft. The Ye-5/1 took to the air on 9th January, and by 18th February (up to and including) the machine had made seven flights. On 20th February, as the engine was being ground-run, the turbine disintegrated and a fire erupted, causing the aircraft to be grounded for repairs. The Ye-5/1 was returned to the prototype construction facility in Moscow where the repair work took place between 23rd February and 15th March.

On 28th February 1956 the Council of Ministers let loose with yet another directive (No. 424-261). This document and the appropriate MAP order No. 194 that followed a week later, on 6th March, set a more specific task for the Mikoyan OKB regarding the Ye-5. Thus, the maximum speed was stipulated as at least 1,250-1,300 km/h (776-807 mph) at sea level and at least 1,700-1,750 km/h (1,056-1,087 mph) at 11,000 m (36,090 ft). The fighter was to climb to 10,000 m (32,810 ft) in full afterburner in no more than 1.5 minutes; the service ceiling was to be at least 17,000-18,000 m (55,770-59,055 ft), while the required range at 10,000 m was at least 1,500 km (931 miles) on internal fuel only and 2,000 km (1,242 miles) with a drop tank. The take-off run in full afterburner and the landing run were not to exceed 400 m (1,310 ft) and 700 m (2,300 ft) respectively.

Between 26th March and 19th May 1956 the repaired fighter made another eight flights under the manufacturer's flight test programme. On the latter date the engine suffered another turbine failure during the 15th flight; the engine was replaced and the flights resumed, but just ten days later, on 29th May, the turbine came apart again! After this the Ye-5/1 was grounded until 14th June for want of a replacement engine. Between 15th and 24th June the first prototype



▶ **A poor but rare shot of the Ye-5/1 in flight.**

made another series of eight test flights, whereupon modifications were made to the fuel system. Five more flights followed between 14th and 24th July; on 7th August the engine was removed and sent back to plant No. 300 (the Mikulin OKB's experimental facility) for modifications.

The AM-11 turbojet (by then redesignated R11-300) remained as unreliable as ever. On 22nd September the Mikoyan OKB took delivery of yet another new engine for the Ye-5/1; yet, as early as 9th October this engine threw a tantrum when the main fuel injector's attachment bolts failed in the aircraft's 30th flight. On 18th October MAP issued a grounding order, banning all further flights of aircraft powered by production R11-300 engines until further notice.

On 27th October 1956 the rear fuselage of the Ye-5/1 was trucked back to plant No. 155 for modifications that would enable installation of an upgraded engine with a larger-diameter afterburner. The forward fuselage followed suit on 24th November; it was stretched by inserting a 400-mm (1 ft 3¾ in) 'plug' between frames 20 and 22, which produced a forward shift in the aircraft's centre of gravity. This also increased the landing gear wheelbase to 4.81 m (15 ft 9⅝ in).

The Tupolev Tu-98 experimental tactical bomber makes a flypast during a rehearsal for an air parade in Moscow in 1957 (which was eventually cancelled), with a production Ye-5 (MiG-21) on the port wing and the Ye-4 on the starboard wing. ▼

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A number of other changes were made to the Ye-5/1, proceeding from the initial assessments of the fighter's longitudinal stability and controllability. Specifically, the original BU-27 tailplane actuator and BU-28 aileron actuator were replaced by the BU-44 and BU-45 models respectively. In common with the Ye-4, the wings were fitted with three pairs of boundary layer fences, the inboard and centre ones extending beyond the wing leading edge, but had pure-delta wings. The stabilator control circuit now included an ARU-3V control governor adjusting the gearing ratio to suit the speed and altitude – again borrowed from the Ye-4; also, the stabilator trailing edges were fitted with bendable trim tabs angled 4° up, with a chord equal to 4% of the stabilator chord.

On 22nd February 1957 the modified aircraft was redelivered to the flight test facility. Ground checks of the powerplant, fuel system and other equipment continued until 22nd March; on 23rd March the Ye-5/1 was reflown in its new guise, making a further 35 test flights by 17th July.

The Ye-5's neutral CG position was determined on the Ye-4 development aircraft whose airframe was identical to that of the Ye-5/1 prior to the modifications described above. After the modifications, two flights were made specifically to determine the neutral CG position – in the 34th flight the machine had a forward CG obtained by installing 85 kg (187 lb) of ballast in the nose, while in the 36th flight it had an aft CG by removing 165 kg (363 lb) from the avionics bay. With the stretched fuselage, the Ye-5's neutral CG position was 37% mean aerodynamic chord (MAC) at Mach 0.7 and 44% MAC at Mach 1.

On 17th July 1957, tailplane buffet set in during the fighter's 65th flight and the tests were suspended. Following instructions from Chief Designer Artyom I. Mikoyan, the Ye-5/1 was delivered to the OKB's prototype construction facility where the flight control system was subjected to vibration tests between 22nd August and 1st December. Proceeding from the results of the tests, the designers modified the control system between 1st December 1957 and 9th January 1958 in order to stiffen it and preclude self-induced oscillations; concurrently several equipment items with expired warranty dates were replaced by fresh ones. On 10th January the Ye-5/1 was returned to Zhukovskiy and the manufacturer's flight tests resumed.

More modifications followed between 28th January and 1st April: anti-flutter weights were fitted to the stabilator tips and the crew rescue system was revised. Between 1st April and 26th May the first prototype made a further 13 flights

under a special programme to explore the performance of the modified aircraft and its upgraded engine.

It should be noted that the 'Manufacturer's flight test report of the MiG-21 delta-wing light tactical fighter powered by the R11-300 engine (*izdeliye* Ye-5)' does not state clearly which of the two prototypes was used to obtain this or that specific performance figure. It is known that a second prototype designated Ye-5/2 was built and tested; yet it was the first aircraft with a normal all-up weight of 6,024 kg (13,280 lb) that apparently bore the brunt of the performance testing.

The report gives the following weight figures for the Ye-5/2. The aircraft had an empty weight of 4,443 kg (9,795 lb), a normal TOW of 6,230 kg (13,730 lb) and a maximum TOW of 6,594 kg (14,537 lb). The normal and maximum payload was 1,787 kg (3,939 lb) and 2,151 kg (4,742 lb) respectively.

The internal fuel load of 1,500 kg (3,306 lb) was distributed as follows: 200 kg (440 lb) in the No. 1 tank, 500 kg (1,102 lb) in the No. 2 tank, 230 kg (507 lb) in the No. 3 tank, 170 kg (375 lb) in the No. 4 tank and 200 kg each in the Nos. 5 and 6 tanks. The 400-litre (88 Imp gal) drop tank held 330 kg (727 lb) of fuel, increasing the total fuel load to 1,830 kg (4,034 lb). 3 kg (6.6 lb) of petrol were provided for engine starting. The cannon ammunition weighed 168 kg (370 lb), the oxygen supply accounting for another 2 kg (4.4 lb) and the windscreen de-icing fluid for another 4 kg (8.8 lb).

The Ye-5/2 had a normal wing loading of 274 kg/m^2 (56.17 lb/sq ft) and a maximum wing loading of 286 kg/m^2 (58.63 lb/sq ft). The thrust/weight ratio was 0.81 in normal take-off weight configuration and 0.78 in maximum TOW configuration; the payload/weight ratio was 28.4% and 32.6% respectively.

The manufacturer's flight tests had shown the following performance figures. The Ye-5/1 had a top speed of 1,370 km/h (851 mph) at 5,140 m (16,860 ft) and 1,970 km/h (1,224 mph) at 10,800 m (35,430 ft). The aircraft attained an altitude of 5,000 m (16,400 ft) in just 0.6 minutes, climbing to 10,000 m (32,810 ft) in 1.38 minutes and to 15,000 m (49,210 ft) in 4.1 minutes. The service ceiling was 17,650 m (57,910 ft); range on internal fuel was 1,313 km (815 miles), increasing to 1,620 km (1,006 miles) with a drop tank, while endurance was 1 hour 32 minutes and 1 hour 50 minutes respectively.

The fuel consumption at 12,000 m (39,370 ft) and 885 km/h (550 mph) was 0.8 kg/km (2.84 lb per mile). The actual specific fuel consumption (SFC) of the R11-300 engine obtained during tests was 0.92 kg/kgp·hr (lb/lbst·hr), which was rather higher that the 0.84 kg/kgp·hr advertised by the manufacturer. The aircraft required 66 seconds to accelerate from 1,575 to 1,870 km/h (from 978 to 1,162 mph) at 11,000 m(36,090 ft) and 32 seconds to accelerate from 1,100 to 1,310 km/h (from 683 to 814 mph) at 5,000 m (16,400 ft).

It was established that the fighter's minimum turning radius at 5,000 m was 1,450 m (4,760 ft) in full afterburner and 1,500 m (4,920 ft) at full military power. The Ye-5 performed a 360° turn at 860 km/h (534 mph) and 740 km/h (460 mph) respectively, pulling 4.2 Gs in the former case and 3 Gs in the latter case. The minimum sustained turn time at the same altitude was 35 seconds at 1,000 km/h (621 mph) in full afterburner and 46 seconds at 760 km/h (472 mph) at full military power, the aircraft pulling 5 Gs and 3 Gs respectively. At 10,000 m the minimum turning radius was 2,630 m (8,630 ft) in full afterburner and 3,200 m (10,500 ft) at full military power at 935 km/h (581 mph) and 840 km/h (521 mph) respectively, the G load being 2.8 Gs in the former case and 2 Gs in the latter case. The minimum sustained turn time at the same altitude was 63 seconds at 970 km/h (602 mph) in full afterburner and 85 seconds at 860 km/h (534 mph) at full military power, with the same G loads.

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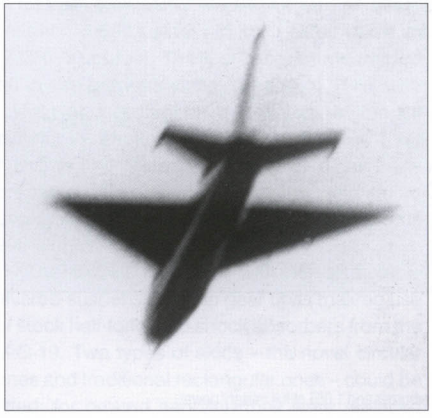


◄▲
These views of the Ye-5 from the 1957 flypast show that the twin canted ventral fins have been removed.

The Ye-5's rate of climb (as per manufacturer's flight tests)

Altitude, m (ft)	Rate of climb, m/sec (ft/min)	Climb time, min	Mach number
0	194.0 (38,180)	0	0.856
5,000 (16,400)	120 (23,620)	0.6	0.91
10,000 (32,810)	49.0 (9,640)	1.38	1.025
11,000 (36,090)	43.2 (8,500)	1.75	1.27
12,000 (39,370)	36.8 (7,240)	2.17	1.27
13,000 (42,650)	30.0 (5,900)	2.66	1.27
14,000 (45,930)	24.0 (4,720)	3.28	1.27
15,000 (49,210)	17.5 (3,440)	4.1	1.27
16,000 (52,490)	11.5 (2,260)	5.27	1.27
17,000 (55,770)	5.0 (980)	6.24	1.27
17,650 (57,910)	0.5 (98)	n.a.	1.27

Statistics

Engine power	Altitude, m (ft)	Mach number	Speed, km/h (mph)	Test flight Number	Date
Full military power	9,900 (32,480)	1.01	1,058 (657)	2	24.01.56
Full military power	10,520 (34,510)	1.028	1,060 (658)	4	15.02.56
Full military power	11,070 (36,320)	1.027	1,110 (689)	8	26.03.56
Full military power	10,750 (35,270)	1.065	1,110 (689)	8	26.03.56
Afterburner	10,880 (35,695)	1.696	1,820 (1,130)	n.a.	14-17.05.56
Afterburner	10,800 (35,430)	1.85	1,970 (1,223)	15	19.05.56
Full military power *	4,080 (13,385)	0.945	1,120 (695)	17	15.05.56
Afterburner	10,700 (35,100)	1.7	1,820 (1,130)	40	19.04.57
Afterburner	5,140 (16,860)	1.2	1,370 (851)	60	21.06.57

* acceleration aborted due to aileron buffet

Basic performance of the Ye-5

	As per CofM directive	Test results
Maximum speed at 11,000 m (36,090 ft), km/h (mph)	1,700-1,750 (1,056-1,087)	1,970 (1,223)
Climb time to 10,000 m (32,810 ft) in full afterburner, minutes	1.5	1.4
Range at 10,000 m, km (miles):		
on internal fuel	1,500 (931)	1,313 (815)
with a 400-litre (88 Imp gal) drop tank	2,000 (1,242)	1,620 (1,006)
Endurance at 10,000 m:		
on internal fuel	–	1 hr 32 min
with a 400-litre drop tank	–	1 hr 50 min
Take-off run, m (ft)	400 (1,310) *	730 (2,395) †
Landing run, m (ft)	700 (2,300)	890 (2,920) ‡

* in full afterburner

† at full military power

‡ without brake parachute

The maximum Mach number was 1.85 in full afterburner and 1.065 at full military power.

The Ye-5 became airborne after a take-off run of 730 m (2,395 ft) and the take-off distance to an altitude of 25 m (82 ft) was 1,670 m (5,480 ft); the unstick speed was 290 km/h (180 mph) without external stores or 335 km/h (208 mph) with a drop tank. The landing run was 890 m (2,920 ft) and the landing distance from an altitude of 25 m was 1,648 m (5,480 ft), the landing speed being 220 km/h (136 mph). The maximum landing weight was 4,890 kg (10,780 lb). The operational G limit was 8.65 Gs at 970 km/h (602 mph) and 3,400 m (11,155 ft), with an all-up weight of 5,735 kg (12,640 lb).

The test pilots assessed the cockpit of the Ye-5 as being roomier than that of the production MiG-19 fighter and the view from the cockpit was better as well. On the minus side, because of the narrow wheel track the fighter had a large turning radius on the ground and was reluctant to make turns – that is, in the original configuration with a castoring nosewheel and steering by differential braking only. The situation improved when a steerable nose gear unit was fitted.

The delta-wing fighter presented no problems during the landing approach; landing gear extension caused no change in pitch trim. The Ye-5 was stable in all flight modes and showed more pleasant handling at supersonic speeds than the MiG-19. Oscillation of the control runs was detected at 11,000-14,000 m (36,090-45,930 ft) when the afterburner was engaged; in so doing the fighter pulled negative G for up to 15 seconds.

The manufacturer's test programme included engine restarting in the event of a flameout. The R11-300 turbojet was shut down at 17,500 m (57,415 ft), and automatic restarting was successful on the first try once the aircraft had descended to 10,000 m (32,810 ft).

Thus the Ye-5 fighter prototype had provided a detailed insight into the aerodynamics of a delta-wing aircraft at speeds up to Mach 1.85 and altitudes up to 18,000 m (59,055 ft). The manufacturer's flight test programme included a total of 98 flights.

Part of the Ye-5's test programme was 'entrusted' to other Mikoyan aircraft having considerable commonality with the new fighter. Thus, the R11-300 engine, the pressurised cockpit, the landing gear, the hydraulics and the pneumatic system were put through its paces on the Ye-2A (MiG-23). The Ye-2A was also used to verify the armament. The structurally identical but lower-powered Ye-4 delta-wing fighter was 'responsible' for the spinning tests.

The concluding part of the manufacturer's flight test report said that the MiG-21 (Ye-5) tactical fighter had passed the tests successfully,

meeting the stipulated performance targets, with the exception of range. The shortfall in range was due to the R11-300 turbojet's higher-than-advertised fuel consumption; on the other hand, the engine-driven accessories had functioned reliably and the engine had run stably in all flight modes. The report was signed by project test pilot Gheorgiy A. Sedov and test pilot Vladimir A. Nefyodov; General Designer Artyom I. Mikoyan endorsed the document on 20th August 1958.

Some figures from the Ye-5/1's manufacturer's flight test report are given in the tables on the opposite page.

Interestingly, the test report says that no fewer than eleven (!) R11-300 engines were used in the course of the manufacturer's flight tests – ten units from what appears to be a pre-production batch (c/ns 22, 26, 30, 32, 35, 36, 38, 42, 45 and 47) and a production example (c/n 1004). However, there are reasons to believe that not all of these engines actually powered the Ye-5 prototypes and that some of them were in fact fitted to the Ye-2A, which was also heavily involved in the Ye-5 programme.

Pursuant to a Council of Ministers directive dated 11th June 1956 and an MAP order dated 18th June the Ye-5 tactical fighter entered low-rate initial production (LRIP) at the Tbilisi aircraft factory No. 31 named after Gheorgiy Dimitrov. The fighter received the service designation MiG-21 and was known at the factory as *izdeliye* 65. Nonetheless, the fighter did not enter mass production, nor was it submitted for State acceptance trials. This was because the Mikoyan OKB and the military had placed their bets on a more advanced delta-wing fighter – the Ye-6 (the future MiG-21F; see Chapter 2).

While the manufacturer's tests of the Ye-5 were still in progress, a grand air event took place at Moscow-Tushino on 26th July 1956, involving a flypast of all the latest combat, transport and commercial aircraft and helicopters – prototypes and production types alike. The Mikoyan OKB was represented by three variations on the soon-to-be-famous MiG-21 theme – the Ye-2 (which was flown by Mikoyan CTP Gheorgiy A. Sedov, commander of MAP's development aircraft group at the event), the Ye-4 flown by Vladimir A. Nefyodov and the Ye-5/1 flown by Gheorgiy K. Mosolov.

A similar air event involving many development aircraft was to take place in 1957 but was cancelled at the last moment. However, the Ye-4 and Ye-5 did appear over Tushino that year during the rehearsal of the event, flying escort for the Tupolev '98' (Tu-98) twin-turbojet supersonic medium bomber prototype.

The Tbilisi aircraft factory commenced production of ten LRIP MiG-21s in 1957. Some sources indicate only five of them were actually completed. Considering that the MiG-21 sans suffixe (Ye-5) had evolved into the more advanced MiG-21F (Ye-6), in 1958 the Mikoyan OKB and the Tbilisi aircraft factory ceased all further work on the former type in keeping with a Council of Ministers directive backed by an appropriate GKAT order.

The two Moscow-built Ye-5 prototypes and the production MiG-21s *sans suffixe* found use as 'dogships', participating in various test programmes. A production MiG-21 sans suffixe (c/n 65310108 – that is, *izdeliye* 65, plant No. 31, Batch 01, 08th aircraft in the batch) was assigned to the Mikoyan OKB, arriving at the prototype construction facility on 31st January 1958. This aircraft was converted into the second prototype MiG-21F (the Ye-6/2).

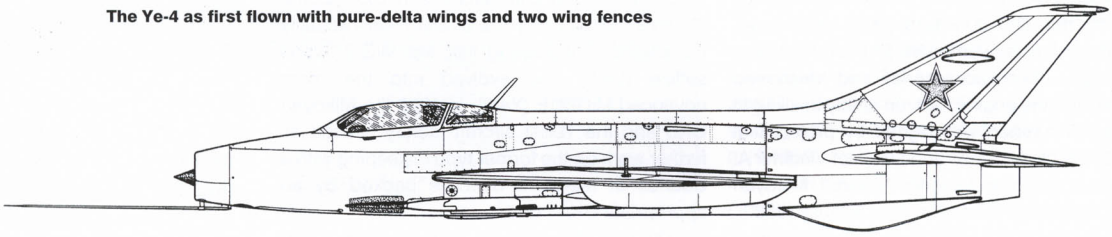
Ye-5/2 development aircraft with skid landing gear

In the late 1950s the Soviet Air Force attached much importance to the ability of its aircraft to operate from unpaved tactical airstrips that could be set up near the frontlines. Therefore at that time the Mikoyan OKB's landing gear design group evolved a unique skid landing gear design as part of the effort to refine the MiG-21. The 'skids' were quite unlike the devices traditionally described by this term – they were circular, functioning as metal wheels on paved runways and as skids on dirt strips; the idea was pioneered by M. N. Voronov.

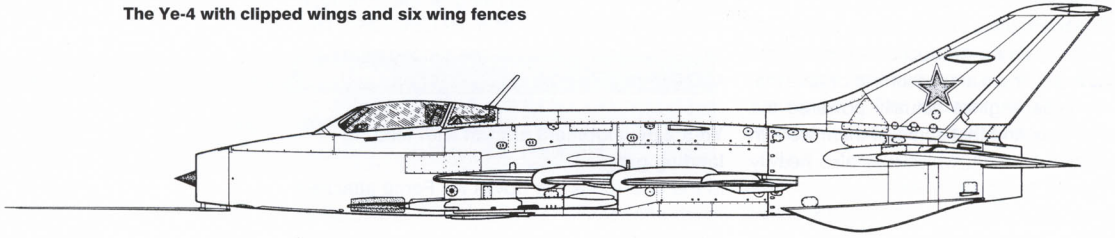
The circular skids were tested in 1960 on the specially modified Ye-5/2, which had by then received the tactical code '12 Red'. The aircraft was flown by Mikoyan OKB test pilots Gheorgiy K. Mosolov and Konstantin K. Kokkinaki, with Ye. F. Nashchokin as engineer in charge. The aircraft was light, with an all-up weight of 5,500 kg (12,125 lb), including 910 kg (2,010 lb) of fuel. The test programme started off in the autumn/winter season of 1959 with towing and taxiing on a dirt strip at the LII airfield in Zhukovskiy. From 4th May 1960 onwards the tests proceeded at a specially prepared dirt airfield (Tret'yakovo airfield in Lookhovitsy, Moscow Region), continuing until 29th July.

The aircraft was fitted with non-retractable levered-suspension main gear units making use of stock half-forks and shock absorbers from the MiG-19. Two types of skids – the novel circular ones and traditional rectangular ones – could be fitted; for ground handling they were replaced

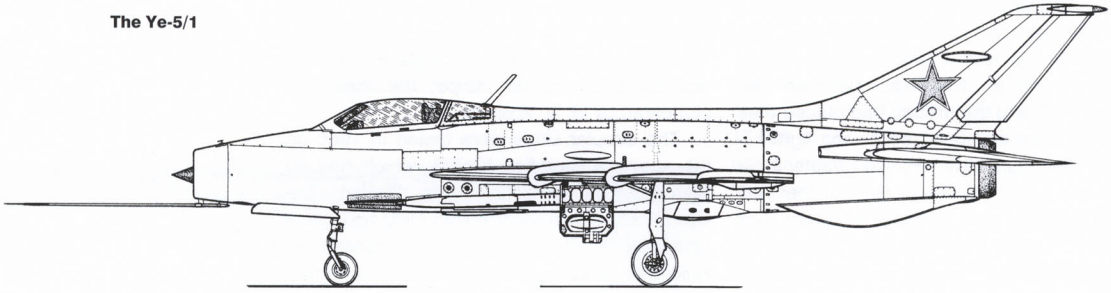
The Ye-4 as first flown with pure-delta wings and two wing fences



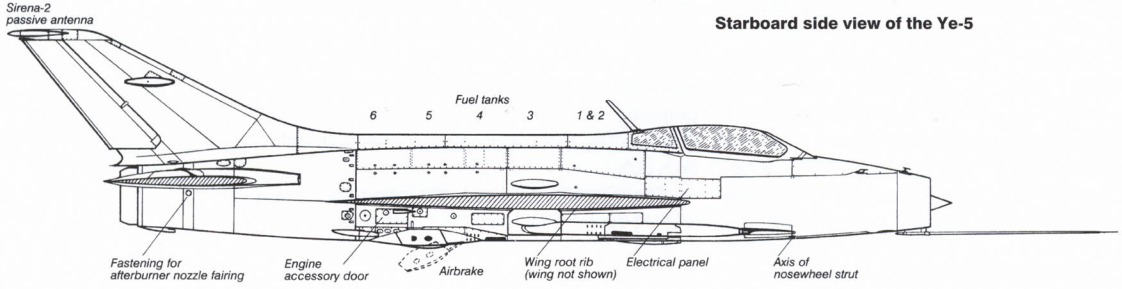
The Ye-4 with clipped wings and six wing fences

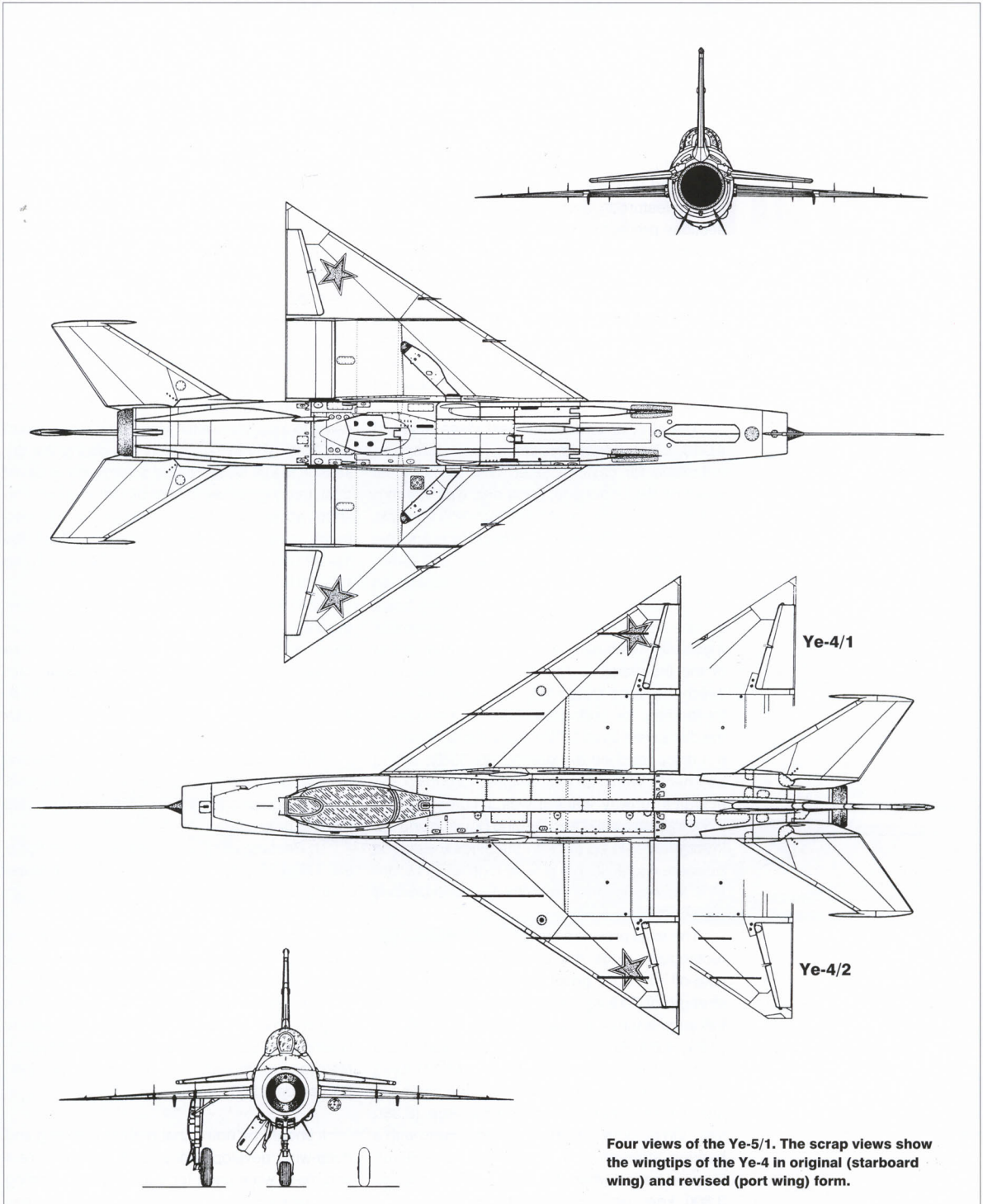


The Ye-5/1



Starboard side view of the Ye-5





Four views of the Ye-5/1. The scrap views show the wingtips of the Ye-4 in original (starboard wing) and revised (port wing) form.

with dummy wheels. The nose gear unit was patterned on that of the production MiG-21F, featuring a 500 x 180 mm (19.68 x 7.08 in) KT-38 nosewheel and an MRK-10 steering mechanism (*mekha**nizm** razvo**rot**a kole**sa***).

The rectangular skids were AL-19 aluminium alloy castings measuring 1,168 x 240 mm (45⁶⁄₆₄ x 9²⁹⁄₆₄ in); the surface resting on the ground measured 900 x 210 mm (35⁷⁄₁₆ x 8¹⁷⁄₆₄ in). The skids featured detachable upturned nose sections preventing them from digging into soft or soggy ground. Additional trailing arms were attached to the rear ends of the skids, moving in parallel with the half-forks to ensure that the skids remained parallel to the ground, regardless of oleo compression. To stabilise the aircraft's movement on soft and soggy ground the skids were fitted with removable stabilising keels on the underside.

The circular skids were cast discs made of AL-19 alloy (*alyu**mini**y li**tey**nyy* – aluminium optimised for casting) faced with EI-659 steel sheet on the underside. Each disc was 724 mm (2 ft 4½ in) in diameter and 126 mm (4³¹⁄₃₂ in) thick; the junction between the undersurface and the sides of the discs was curved, with a 300-mm (11¹³⁄₁₆ in) radius. The discs were mounted on vertical axles with roller bearings, rotating freely in the horizontal plane; the suspension mechanism with parallel arms was similar to that of the first version. The horizontal position (in which the discs rested fully on the ground) was for landing; for taxiing and take-off the axles of the discs were tilted 15° by hydraulic rams so that the discs touched the ground obliquely, acting as wheels. With a take-off weight of 5,500 kg, the aircraft's runway loading was 1 kg/cm² (14.28 lb/sq in) with the skids in landing position and 2.5 kg/cm² (35.7 lb/sq in) with the skids in take-off position. A keel 30 mm (1³⁄₁₆ in) high and 115 mm (4³³⁄₆₄ in) was located centrally on the underside of each disc.

The tests provided the following results. With rectangular skids the aircraft commenced its take-off run on a grass surface with a bearing strength of 7-15 kg/cm² (100-214 lb/sq in) when the engine thrust amounted to 1,300-2,100 kgp (2,865-4,630 lbst); with the turf removed and a bearing strength of 10-12 kg/cm² (142-171 lb/sq in) the aircraft started moving with the engine in afterburner mode delivering 3,800 kgp (8,380 lbst). On ploughed and then rolled ground with a bearing strength of 7 kg/cm² the take-off run likewise began when the engine thrust reached 3,800 kgp; on snow-covered ground with a bearing strength of 15 kg/cm² a thrust of 1,700 kgp (3,750 lbst) was enough.

The Ye-5/2's directional stability and controllability during take-off and landing were adequate on all types of runway surface; however, taxiing at speeds up to 40-60 km/h (25-37 mph) on soggy ground and frozen earth revealed inadequate stability. Taking off from a dirt strip was somewhat more complicated as compared to operation from a paved runway – the nosewheel was reluctant to lift, but when it did the aircraft became airborne immediately. The landing procedure was also more complicated, as the aircraft dropped its nose immediately on touchdown instead of the usual nose-up run.

On a grass strip with tall grass and a bearing strength of 12-15 kg/cm² the aircraft had a take-off run of 800-1,000 m (2,640-3,280 ft), becoming airborne at 310 km/h (192 mph); on landing the fighter touched down at 320 km/h (198 mph) and came to a standstill after a landing run of 1,760 m (5,770 ft). The testers noted that during the dry season the jet blast created a tremendous pall of dust, making formation take-offs impossible. The shock absorption of the landing gear also proved to be inadequate. With rectangular skids the Ye-5/2 had a normal take-off weight of 5,535 kg (12,200 lb).

The circular skids created somewhat higher drag when moving on the ground; on the other hand, with these skids the aircraft was more manoeuvrable on the ground, making tighter turns when one of the skids was set horizontal. At 60 km/h (37.2 mph) the aircraft tended to yaw on take-off and landing.

The concluding part of the 'Report on the taxi tests on unpaved strips undertaken with the Ye-5 aircraft equipped with an experimental skid landing gear' stated:

'1. Rectangular skids: It is advisable to equip the MiG-21F with skids, taking account of the changes made to the aircraft's design. (as compared to the Ye-5 – Auth.)

2. The circular skids undoubtedly offer the advantage of higher manoeuvrability and easier setting in motion on hard-packed earth surfaces.'

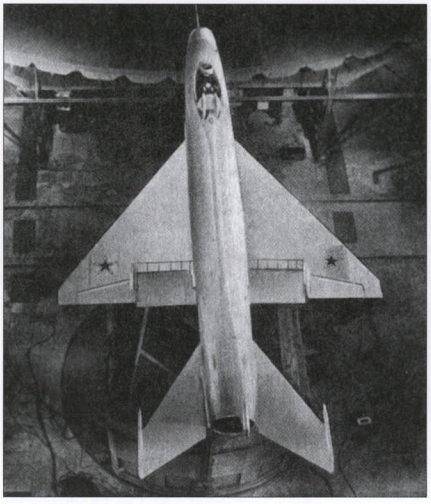
The report was signed by the MiG-21's project chief A. G. Broonov and his deputy Gheorgiy A. Sedov; General Designer Artyom I. Mikoyan endorsed the document on 28th September 1960.

* * *

It should be noted that both swept-wing and delta-wing development aircraft (the Ye-2, Ye-4 and Ye-5) were used for a long time for testing and refining the powerplant, fuel system, hydraulics and other systems of the production MiG-21 fighter variants.

PART TWO

OFF TO A FINE START



TsAGI

A full-scale MiG-21F (Ye-6) in the T-101 wind tunnel at TsAGI.

Ye-6 (MiG-21F) Fighter Prototypes

In 1957 OKB-155 completed the design work on the MiG-21F tactical fighter (known in-house as the Ye-6) – an aerodynamically cleaned-up version of the initial-production MiG-21 *sans suffixe* (Ye-5). Thereupon the Mikoyan OKB began issuing the manufacturing drawings, while its prototype construction facility started manufacturing the assembly jigs and cut the first metal on the Ye-6 prototype.

According to the ADP the MiG-21F (Ye-6) introduced a whole raft of changes as compared to the Tbilisi-built MiG-21 *sans suffixe* (*izdeliye* 65). First and foremost, the R11-300 engine was replaced by an improved R11F-300 turbojet uprated to 5,740 kgp (12,650 lbst), hence the F suffix standing for *for**see**rovannyy* (uprated). The new engine featured a modified afterburner with a fully adjustable (all-mode) nozzle allowing the thrust in reheat mode to be adjusted smoothly. As compared to the original model, the R11F-300 incorporated numerous refinements. Changes were made to the compressor duct and rotor (all compressor stages were now supersonic); the milled combustion chambers were replaced by welded ones; the second turbine stage featured narrower blades and the diameter of the high-pressure turbine was increased by 15 mm (0⁹⁄₃₂ in). The afterburner featured a wide diffuser giving more stable combustion and the thrust increase in full afterburner versus full military power reached 50%. The R11F-300 introduced an oxygen feed system facilitating engine starting and a self-contained lubrication system.

Secondly, the detachable rear fuselage aft of the fuselage break point was designed anew and changes were made to the tail surfaces; in particular, the stabilators were set somewhat lower with respect to the fuselage waterline. This, in turn, necessitated changes to the control system and other equipment housed in the rear fuselage. The two canted strakes under the rear fuselage gave place to a single ventral fin of greater area on the centreline.

Changes were made to the forward fuselage as well: the MiG-21F had a redesigned sharp-lipped air intake with a new movable two-shock centrebody. This required the AKS-5 gun camera to be relocated. Plans were in hand to install a new low-drag cockpit canopy that no longer acted as a shield against the slipstream during ejection but this was not done at this stage, the fighter retaining the one-piece forward-hinged canopy. The MiG-21F was, however, equipped with a new ejection seat developed by the aforementioned OKB-918 under Guy Il'yich Severin that permitted safe ejection at higher altitudes.

Changes also concerned the fighter's armament, avionics and equipment. The number of cannons was reduced to three by deleting the centre (rear) cannon and the fuselage structure in the area was altered accordingly. The wing structure was also revised to incorporate hardpoints for two BD3-58-21 pylons with BD3-55T shackles, permitting the carriage of unguided rocket pods; the rockets were to be fired by means of a PU-2 control system.

The wing pylons allowed the MiG-21F to fly strike missions. The main weapons to be carried on these pylons were rocket pods – either two ORO-57K eight-tube pods or two UB-16-57 sixteen-tube pods holding 57-mm (2.24-in) ARS-57 (aka S-5), ARS-57M or KARS-5A FFARs. Alternatively, two 212-mm (8.34-in) ARS-212M Ovod-M (Gadfly; aka S-21) heavy unguided rockets on APU-O-212 launchers or two 240-mm (9.44-in) ARS-240 heavy unguided rockets on PU-12-40 launchers could be carried. Free-fall weapons included two 50-kg (110-lb) FAB-50, 100-kg (220-lb) FAB-100, 250-kg (551-lb) FAB-250 or, in maximum TOW configuration, 500-kg (1,102-lb) FAB-500 high-explosive bombs – or two ZB-360 napalm tanks. (Note: ARS = *aviatsi**on**nyy reak**tiv**nyy sna**ryad*** – [high-velocity] aircraft rocket (HVAR). APU-O-212 = *aviatsi**on**naya pooskо**va**ya oosta**nov**ka, odi**noch**naya, [dlya sna**rya**dov ka**libra**] 212 milli**metr**ov* – aircraft-mounted launcher, single, for 212-mm HVARs; also called PU-21. FAB = *foo**gahs**naya **a**via**bom**ba* – HE bomb; ZB = *zazhi**gah**tel'nyy bahk* – lit. 'incendiary tank'.)

The SRD-1M Konus radar rangefinder housed in the air intake centrebody gave place to a more sophisticated model, the SRD-5M Baza-6. This was linked to a new ASP-5N computing gunsight; so was a new targeting system, the SIV-52 forward-looking infrared sensor (*samo**lyot**nyy infra**krahs**nyy vi**zeer*** – aircraft-mounted IR sight). Some avionics items gave place to newer ones; thus, the MiG-21F had an ARK-54 ADF instead of the predecessor's ARK-5 and an MRP-56P marker beacon receiver instead of an MRP-48P. An SOD-57M Globus-2 decimetre-waveband transponder was fitted (SOD = ***stahn**tsiya opredele**niya **dahl'**nosti*** – distance measuring equipment), while the Sirena-2 RWR was deleted.

The fuel system now included a 760-litre (167.2 Imp gal) drop tank carried on the centreline; it had a very distinctive appearance with a pointed nose and four shallow stabilising fins arranged in cruciform fashion. An important new feature was the addition of a brake parachute, which was stowed in a bay at the rear end of the ventral fin covered by bulged doors. The KKO-1 breathing apparatus was replaced by a KKO-3 set.

Bearing the designation Ye-6/1 and wearing no tactical code, the first prototype MiG-21F was rolled out and prepared for flight tests in the spring of 1958. As compared to the ADP configuration the actual aircraft had a slightly different avionics fit and featured a data link aerial on the underside of the nose; the data link system was part of the test equipment suite.

The manufacturer's flight tests officially began on 16th May 1958. Four days later

RSK MiG

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Three views of the Ye-6/1, the first prototype MiG-21F. The mid-set tailplanes and single ventral fin are clearly visible; note the fairings where the tailplanes used to be on the Ye-5. Like the Ye-5, the Ye-6/1 had three boundary layer fences on each wing. The rear airbrake is slightly open.

RSK MiG

▶ **'23 Red', the third prototype MiG-21F (Ye-6/3). This view shows clearly that the inboard and centre pairs of wing fences have been deleted. Note the new triple rod aerials of the IFF transponder on top of the fin.**

OKB-155 test pilot Vladimir A. Nefyodov took the fighter up on its maiden flight. Sadly, the first prototype's flying career proved to be brief; on 28th May 1958 the Ye-6/1 crashed on its seventh flight, Nefyodov losing his life.

On that day the Ye-6/1 suffered engine surge in the middle of the test mission. Sensing the violent vibration of the aircraft, Nefyodov radioed that he was experiencing flutter – a pardonable error, considering that he had not experienced either phenomenon 'live'. Next thing, the engine flamed out and would not relight. Keeping a cool head, the pilot carefully calculated the landing approach and initiated a dead-stick landing at Zhukovskiy; the engine was windmilling, providing just enough hydraulic power to keep the control system working. However, when the altitude was down to 1 m (3 ft), the hydraulic pressure suddenly dropped, putting the control system actuators out of action. The back-up electric stabilator drive kicked in, but it was a case of too little, too late – the stabilator travel rate in electric control mode was far too low. Thus Nefyodov was unable to flare out; touching down hard in a nose-down attitude and collapsing the nose gear, the fighter rolled over and slithered along the runway in a shower of sparks. It was burning when it came to rest on the runway shoulder in a cloud of smoke and dust.

The crash rescue team rushed to the scene and extracted the pilot from the cockpit – no easy job because the fighter's fin had broken so that the machine lay flat and one of Nefyodov's arms had become entangled in the pressure suit's

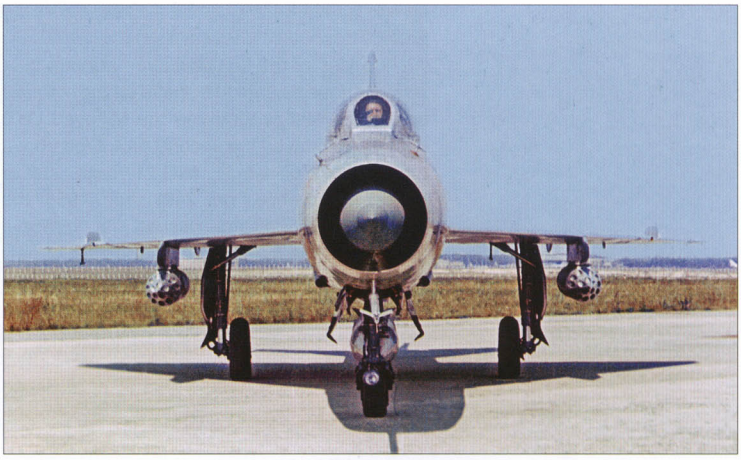
RSK MiG

▶ **This view of the Ye-6/3 accentuates the fighter's clean lines and shows the rounded BD3-58-21 wing pylons. The grey areas at the wing roots are walkways. Note the darker shade of metal on the extreme rear fuselage.**

▶▲ ▶▶ **Three more aspects of '59 Red' with two UB-16-57UM rocket pods under the wings and a PTB-490 drop tank on the centreline. The spring-loaded blow-in doors are well visible ahead of the wing roots, and the powered anti-surge doors are discernible ahead of the tactical code. Note the landing light attached to the nose gear unit.**

hoses, which had to be cut. The fire-fighters managed to put out the blaze before it could engulf the aircraft, while the ambulance crew treated the pilot's injuries before taking him to a hospital. Nefyodov's condition did not appear critical at that point, so he was taken to an ordinary hospital, not an emergency ward. However, the ill-trained personnel there overlooked the fact that one of his ribs had been fractured, puncturing a lung. When this was discovered it was too late; Nefyodov's condition was deteriorating rapidly and he died a few hours after being hospitalised.

The accident investigation board officially ascertained that the crash had been caused by loss of hydraulic power and hence loss of control due to engine failure. The automatically



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activated emergency electric actuator could not provide adequate control authority.

The loss of the first prototype and the pilot was a serious setback. To speed up the resumption of the test programme the Mikoyan OKB decided to convert the second prototype from a production Tbilisi-built MiG-21 *sans suffixe* (Ye-5). Meanwhile, on 24th July 1958 the Council of Ministers issued a directive demanding the completion and testing of new prototypes pronto. Soon afterwards the OKB took delivery of the eighth production MiG-21 (c/n 65310108), which was transferred to plant No. 155 for conversion into the Ye-6/2. The conversion, which was largely in accordance with the Ye-6's original ADP documents, included the following:

- the R11-300 engine was replaced by an uprated R11F-300;
- the detachable rear fuselage was manufactured anew to incorporate the lower-set horizontal tail and the single ventral fin;
- the rear NR-30 (*izdeliye* 235P) cannon was removed;
- the forward fuselage extremity was remanufactured to incorporate the new sharp-lipped air intake with the two-shock, three-position centrebody that moved forward at Mach 1.4-1.5 and again at Mach 1.9;
- a PT-5759-58 brake parachute (a stock production item) was installed;
- a production ASP-5N computing gunsight linked to an SIV-52 FLIR (the sight was another off-the-shelf item – the intended improved ASP-5NV-U1 gunsight was not yet available);
- the ARK-5 ADF and the MRP-48P marker beacon receiver were replaced by the ARK-54I (or ARK-54N?) and the MRP-56P respectively;
- the KKO-1 breathing apparatus gave place to the KKO-3;
- the wings were modified to take a pair of BD3-58-21 pylons for carrying air-to-surface weapons, and the inboard and centre pairs of wing fences were deleted;
- the control system was modified to include a BU-51M twin-chamber hydraulic actuator in the stabilator control circuit. Learning their lesson from the crash of the Ye-6/1, the designers eliminated the slow electric emergency actuator and installed an NR-27 emergency hydraulic pump instead to provide hydraulic power in the event of engine failure.

The pilot's flying gear included a VKK-4 pressure suit (*vy**sot**no-kompen**see**ruyuschchiy kos**tyum*** – altitude compensation suit) and a GSh-4M full-face pressure helmet (*ghermo-**shlem*** – hermetic helmet).

Coded '22 Red', the Ye-6/2 was cleared for manufacturer's flight tests on 26th August 1958; Mikoyan OKB test pilot Konstantin K. Kokkinaki was assigned project test pilot, with A. S. Izotov as engineer in charge. The second prototype took to the air at Zhukovskiy on 15th September; by 5th November the machine had made fifteen flights from there. Next, pursuant to a GKAT order, the Ye-6/2 was redeployed to Armyak airbase near Krasnovodsk, Turkmenia (the city is now called Türkmenbashi), and the manufacturer's flight tests resumed at this location on 20th November.

The second prototype made a total of 46 flights at this stage of the tests. Two engine changes had to be made in the course of the manufacturer's tests – the original R11F-300 (c/n 510) was replaced by c/n 514, which eventually ran out of service life without suffering any malfunctions, and then by c/n 519. At Krasnovodsk the Ye-6/2 was flown by Konstantin Kokkinaki and Gheorgiy A. Sedov, another OKB-155 test pilot.

The third prototype MiG-21F – the Ye-6/3 ('23 Red') – was cleared for manufacturer's flight tests on 20th November 1958, arriving at Armyak AB in December. This aircraft differed from the preceding two in having two pairs of auxiliary air intakes on the forward fuselage sides ahead of the nosewheel well and ahead of the wing roots; these were meant to prevent engine surge when the engine was throttled back at speeds above Mach 1.5.

All in all, the three MiG-21F prototypes made 61 test flights under the manufacturer's flight test programme, allowing the fighter's basic performance envelope to be explored. Only the second prototype was used for live weapons trials with the twin-cannon installation; these tests took place in Krasnovodsk.

On 27th August 1958 the Ye-6/2 was weighed, yielding the following results. The aircraft's empty weight was 4,669 kg (10,293 lb). The internal fuel load was 1,500 kg (3,306 lb), being distributed as follows: 200 kg (441 lb) in the No. 1 tank, 500 kg (1,102 lb) in the No. 2 tank, 230 kg (507 lb) in the No. 3 tank, 170 kg (374 lb) in the No. 4 tank, and 200 kg each in the Nos. 5 and 6 tanks; the engine oil supply was 10 kg (22 lb). The cannons' ammunition supply, together with the belt links, weighed 112 kg (247 lb). The normal take-off weight without external stores and wing pylons was 6,400 kg (14,110 lb); with a 480-litre (105.6 Imp gal) drop tank (380 kg/840 lb) and pylons (71 kg/156 lb) in place it rose to 6,851 kg (15,103 lb) less unguided rockets and launchers for same, while the payload in this configuration was 1,800 kg (3,970 lb).

Some of the Ye-6's performance figures		
	CofM directive	Manufacturer's flight tests
Maximum speed in full afterburner, km/h (mph)	2,300-2,500 (1,428-1,552)	2,100 (1,304)
Service ceiling in level flight, m (ft)	21,700 (71,190) at Mach 2.1-2.2	20,800 (68,240) at Mach 1.8-1.9
Range at 12,000 m (39,370 ft), km (miles):		
on internal fuel	1,400 (869)	1,230 (764)
with drop tank	2,000 (1,242)	1,550 (962)

The Ye-6's range and endurance (with 7% fuel reserves)					
	Altitude, m (ft)	Range, km (miles)		Endurance, hrs-min	
		on internal fuel	with drop tank	on internal fuel	with drop tank
Ye-6/1	12,000 (39,370)	1,230 (764)	1,550 (962)	1-22	1-41
Ye-6/2	12,000 (39,370)	1,500 (931)	1,800 (1,118)	1-43	2-05

Acceleration characteristics of the MiG-21F and the Mikoyan SM-12		
	Altitude, m (ft)	Speed gain within 60 seconds, km/h (mph)
MiG-21F (Ye-6)	13,000 (42,650)	540 (335) (1,400 to 1,940/869 to 1,205)
MiG-19 (SM-12)	12,000 (39,370)	235 (145) (1,400 to 1,635/869 to 1,015)

During the manufacturer's flight tests the Ye-6/2 was outfitted with a test and recording equipment suite that increased the empty weight to 4,721 kg (10,407 lb). With a 1,410-kg (3,108-lb) fuel load – 188 kg (414 lb), 470 kg (1,036 lb), 216 kg (476 lb), 160 kg (352 lb), 180 kg (396 lb) and 188 kg respectively in the six internal tanks – the fighter's normal take-off weight amounted to 6,250 kg (13,780 lb).

Comparative performance of the MiG-21F and the Mikoyan Ye-150		
	Ye-150	MiG-21F (Ye-6)
All-up weight, kg (lb)	12,435 (27,410)	6,850 (15,100)
Fuel load, kg (lb)	3,410 (7,520)	2,170 (4,780)
Afterburning thrust at sea level, kgp (lbst)	9,500 (20,940)	5,400 (11,900)
Afterburning thrust at 15,000 m (49,210 ft) and Mach 1.8, kgp (lbst)	7,000 (15,430)	5,700 (12,570) *
Afterburning thrust at 11,000 m (36,090 ft) and Mach 2.41, kgp (lbst)	9,800 (21,600)	n.a.
Maximum Mach number	2.5-2.7	2.05
Service ceiling in level flight, m (ft)	23,250 (76,280)	19,800 (64,960)
Climb time, minutes:		
to 15,000 m (49,210 ft)	2.5	6.3
to 20,000 m (65,620 ft)	4.5	9.0 (to 19,800 m)
Landing speed, km/h (mph)	275-295 (170-183)	260-270 (161-167)
Take-off run, m (ft)	935 (3,070)	750 (2,460)
Landing run, m (ft):		
with brake parachute	1,250 (4,100)	900 (2,950)
without brake parachute	1,400 (4,590)	1,200-1,300 (3,940-4,260)

* as per the Ye-6's test report

The Ye-6/2's maximum speed was measured in two acceleration runs in full afterburner at 13,500-15,300 m (44,290-50,200 ft) and was recorded as 2,100 km/h (1,304 mph) at the latter altitude, which equals Mach 1.97. The report on Stage A of the manufacturer's flight tests, which was endorsed on 20th August 1958, stated that the fighter could go even faster, providing the temporary restriction of Mach 2.05 imposed at this stage was lifted.

The Ye-6/2 required 160 seconds to accelerate from Mach 1.24 to its Mach 1.97 top speed, the pilot putting the machine into a gentle climb at the end of the acceleration run. The acceleration tests were performed at an altitude of 11,400 m (37,400 ft).

In the course of the tests the aircraft attained a service ceiling of 20,700 m (67,910 ft), doing Mach 1.84 in full afterburner and climbing to this altitude in 8 minutes 25 seconds. The maximum altitude attained at full military power was 14,500 m (47,570 ft), the fighter travelling at Mach 0.9.

The tests showed that the Ye-6's mid-set stabilators were more effective than the high-set stabilators of the Ye-5, despite having identical area.

The abovementioned report pointed out that the fighter's range fell somewhat short of the stipulated figures because the engine's specific fuel consumption was higher than expected. The first two prototypes had an internal fuel capacity of 1,810 litres (398 Imp gal), which equated to a fuel load of 1,500 kg (3,310 lb); additionally, a low-drag 500-litre (110 Imp gal) drop tank could be carried on a centreline pylon. In order to increase range the Ye-6/2 was modified by incorporating wing tanks increasing the total capacity by 350 litres (77 Imp gal); the internal fuel capacity was now 2,160 litres (475.2 Imp gal) and the fuel load 1,790 kg (3,945 lb). The maximum range and endurance of the first and second prototypes (with 7% fuel reserves) are given in the table on the preceding page.

The Ye-6 showed adequate stability and controllability throughout its speed envelope. Its handling was generally similar to that of the Ye-5.

Table 3 on the preceding page gives a comparison of the acceleration characteristics of the MiG-21F and the Mikoyan SM-12 development aircraft. The latter was a heavily modified MiG-19S featuring a new MiG-21 style nose with a shock cone but retaining the original swept wings and twin-engine powerplant.

Regarding the MiG-21F's field performance, the report pointed out that using the afterburner mode reduced the time from brake release to unstick by 5-7 seconds, the aircraft becoming airborne at 280 km/h (174 mph) in 'clean' configuration. With the drop tank fitted, the unstick speed increased to 315 km/h (195 mph); the landing speed was 240-260 km/h (149-161 mph) and the landing run was 650 m (2,130 ft), decreasing to 450 m (1,480 ft) if the brake parachute was used. The aircraft could sustain G loads up to 7.8; this figure was attained at 3,000 m (9,840 ft) and an indicated airspeed of 1,000 km/h (621 mph). Engine operation was checked at speed up to the aircraft's maximum speed of 2,100 km/h (Mach 1.97) and altitudes up to the aircraft's limit of 20,700 m (67,910 ft).

Test pilot Konstantin K. Kokkinaki assessed the cockpit of the MiG-21F (Ye-6) as more spacious and offering a better forward view than that of the MiG-19. The fighter's turning radius on the ground was smaller than the MiG-19's thanks to the use of a steerable nosewheel assisted by differential braking (in contrast, the MiG-19 had a castoring nosewheel). Stabilator authority during the landing approach was deemed to be adequate. Take-off and landing presented no major problems and, according to Kokkinaki, could be easily mastered by average-skilled first-line pilots converting from the MiG-17 and MiG-19. The test pilot concluded by reporting that *'Proceeding from the flights I have made, I consider that the MiG-21F can be easily mastered by service pilots'*.

Interestingly, the report on Stage A of the MiG-21F's manufacturer's flight tests signed by OKB-155 Deputy General Designer A. G. Broonov and endorsed by General Designer Artyom I. Mikoyan on 26th March 1959 included a table giving a performance comparison of two widely different Mikoyan types which were developed in parallel – the MiG-21F light tactical fighter and the Ye-150 superfast heavy interceptor. The comparison may seem strange, to say the least – or even inadmissible, since the Ye-150 was in a totally different league. Yet there was method in the madness, so to say; by comparing the performance of two very different aircraft they had created the designers of the Mikoyan OKB gave the Powers That Be a chance to see for themselves the strong points of the new light fighter, which, while admittedly less sophisticated than the Ye-150, was also easier to manufacture and easier to master.

In 1959 the Ye-6/2 and the Ye-6/3 underwent joint State acceptance trials at GK NII VVS. These were performed both by Mikoyan OKB test pilots (Aleksandr V. Fedotov and Konstantin K. Kokkinaki) and by Air Force test pilots (Mikhail Tvelyov, Sergey Petrov, Viktor Andreyev *et al.*). The concluding report on the results of the State

acceptance trials said that the MiG-21F had a maximum speed of 2,200 km/h (1,366 mph) – which is equivalent to Mach 2.05, – a service ceiling of 18,000 m (59,055 ft) and a range of 1,100 km (683 miles). The report also pointed out the fighter's directional stability was inadequate – a major shortcoming that had to be addressed.

Trying to ascertain the cause of the directional stability problem, Aleksandr Fedotov discovered that the nozzle petals had buckled as he made a careful inspection of the prototype at the GK NII VVS main facility in Akhtoobinsk (Vladimirovka AB); it was asymmetric thrust that caused the fighter to yaw. Once the defective petals had been replaced and the afterburner reinstalled (an operation that had to be performed fairly often), someone came up with the idea of offsetting the afterburner horizontally by 1.5 mm (0.059 in) to compensate for the deviation in the thrust vector. This would balance the aerodynamic forces with respect to the aircraft's CG.

The idea was accepted, and Fedotov's very first flight in the modified MiG-21F with an offset afterburner gave excellent results – the aircraft was 'rock-steady', as the pilot put it. In order to make sure that their idea was correct, the designers eliminated the bendable trim tabs from the fighter's rudder; Fedotov flew the aircraft again and found no adverse effects. Later, two GK NII VVS test pilots flew sorties in the modified prototype and were pleased with its handling. Thus, with the main problems discovered in the course of the trials being resolved, the MiG-21F was recommended for production and service.

▲ **The uncoded first production MiG-21F (c/n N72210101) in strike configuration with two FFAR pods and a drop tank.**

MiG-21F Tactical Fighter (Ye-6, *izdeliye* 72, *Fishbed-C*)

In 1959 the MiG-21F tactical fighter (the Ye-6) entered production at two major aircraft factories at once – No. 21 in Gor'kiy and No. 31 in Tbilisi. By the end of the year the former plant had completed the first ten production examples; 73 more were manufactured in 1960. MiG-21F production in Tbilisi was limited to just ten examples. The in-house product code at both factories was *izdeliye* 72.

Some sources claim that the first 30 production MiG-21Fs were armed with a single NR-30 cannon and two 23-mm (.90 calibre) Nudelman/Rikhter NR-23 cannons. Later examples, however, reverted to the original arrangement with two NR-30s and an ammunition complement of 60 rounds per gun.

As is often the case, the two plants and their 'subcontractors' had to overcome a few difficulties when launching production of the new fighter. For instance, the 24th February 1959 issue of the Mikoyan OKB gazette *Istrebitel'* (Fighter) testifies that the manufacturing plants were confronted with engine starting problems on the Ye-6. The engine starting procedure on this aircraft was rather different from that used on the production Tbilisi-built Ye-5 and Gor'kiy-built Ye-2A, requiring a fuel tank pressurisation feature to be added to the fuel system. Another problem was that the MiG-21F's rear fuselage was prone to overheating when the engine was running. The 9th June 1960 issue of the *Istrebitel'* gazette included an item stating that the MiG-21F had earned positive comments from the service pilots and the ground crews alike during its service introduction period. Reliability was high enough for four to six sorties to be flown daily (presumably by each aircraft).

One of the major shortcomings noted at the service introduction stage was the propensity of the control surfaces to jamming by foreign

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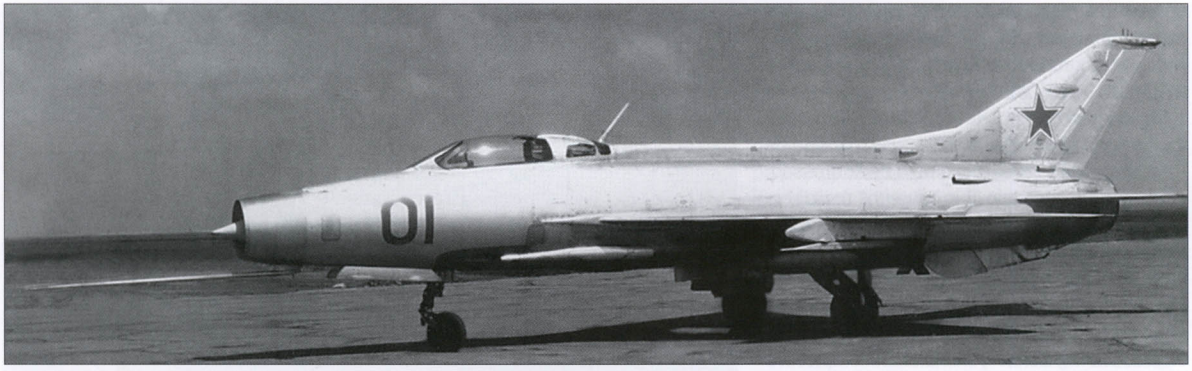

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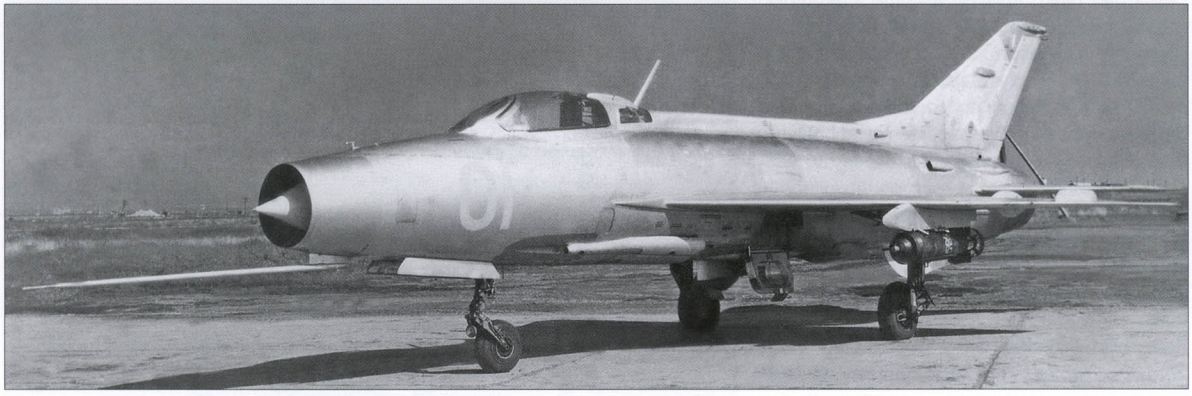

▲▲ **MiG-21F '01 Red' (c/n N72210206) with two S-21 unguided rockets on APU-O-212 launch rails.**

▲ **The same aircraft toting two FAB-250M54 HE bombs.**

MiG-21F '02 Red' (c/n N72210207) with two ZB-360 napalm tanks. ▼

objects. While the Ye-6 prototypes featured special guards preventing foreign object ingress, the production aircraft rolling off the assembly lines lacked these guards for some reason. The design office of the Gor'kiy aircraft factory (OKB-21) made other unauthorised changes to the MiG-21F's design without asking for approval by the head office in Moscow (OKB-155). For instance, OKB-21 introduced a shorter actuating lever for the PU-7 module in the wheel braking system, thereby markedly reducing the braking efficiency.

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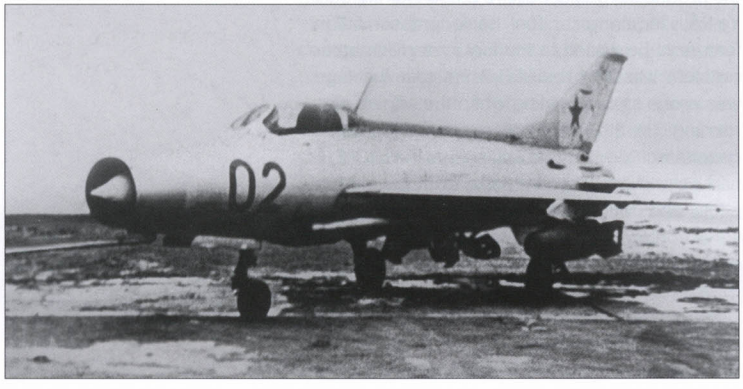

The DC battery used as a back-up power source was another problem area. There were cases of the battery running totally flat on operational MiG-21Fs, which was dangerous. The tech staff noted that the MiG-21F's DC battery installation could use some improvement.

On the other hand, the manufacturing plants also voiced complaints concerning some of the fighter's design features. One of these was the brake parachute installation, which was extremely complex and inconvenient to operate. Loading the packed parachute into its ventral compartment at the rear of the ventral fin required a team of three to five technicians, two of whom had to lie down on the ground and hold the parachute compartment doors open with their feet!

The design of the fuel tanks' draining system also gave rise to complaints. Silly situations arose when the technicians attempted to drain the residue and sediment from the tanks. The *Istrebitel'* gazette wrote that *'...the residue from the No. 1 group of tanks trickled into the technician's sleeve rather than into the can intended for it, while the residue from the No. 4 tank ended up inside the fuselage, dousing everything'*.

Being an in-house publication for those who 'need to know only' (like the design documents and many other things in Soviet days, it was classified and distributed only to persons having appropriate clearances), the gazette did not hesitate to criticise the designers and often stated its viewpoint bluntly. Here is another excerpt: *'The mechanical landing gear position indicator is a damn stupid design. For one thing, it is often damaged when the canvas covers are removed from the aircraft; for another, the pilot simply cannot see it.'*

Still, despite certain manufacturing defects and design flaws, the Soviet Air Force had faith in the MiG-21F and the first-line units looked forward to converting to the new fighter.

In 1960 LII teamed up with GK NII VVS to hold a special spin trials programme with the MiG-21F. The programme, which was based on the experience gained with the Soviet Union's first operational supersonic fighter – the MiG-19, – included the MiG-21F's entire altitude and speed envelope; both normal and inverted spins were explored. Initially the trials were performed by LII test pilots Oleg V. Goodkov and A. A. Shcherbakov and Air Force test pilot V. S. Kotlov; later, Sergey N. Anokhin had to join in later. This is how Shcherbakov recalled these trials in his memoirs:

'The company pilot (that is, Mikoyan OKB test pilot – *Auth.*) *made two or three flights under the spin trials programme and gave an encouraging report. The general view at the time was that three flights were enough to give the answer to the key question – that is, whether the aircraft can recover from a spin at all; details and the effect of various factors on the spinning characteristics could be explored in later flights. Wind tunnel tests* (in TsAGI's T-104 vertical wind tunnel – *Auth.*) *had been performed but their results had not yet been fully processed. Thus, proceeding from the company pilot's report, TsAGI gave a preliminary go-ahead. Flight test work is considered to be a kind of production process, with all the implications – a production plan* (the Soviet Union had a state-planned economy – *Auth.*), *deadlines to meet and obligations to fulfil. [The OKB] had not managed to outfit the aircraft fully by then – the spin recovery rockets were not yet installed. After a deal of discussions the [LII] management suggested that I should begin the trials in as-was configuration (without the rockets) – in the conditions in which the company pilot had flown his test sorties, for a start. After all, the report suggested that the spinning characteristics were benign. To put it metaphorically, the spin was going to be no stress for the aircraft but just a slight nervous reaction. I agreed to begin the trials in rocket-less configuration. The test mission plan stated how I should use the control surfaces during spin recovery, how many attempts I could make, at which altitude the rockets should be brought into play if the control inputs failed to give the desired result and at which altitude I should eject if even the rockets were of no avail. The control surface movements were detailed very specifically – they were based on positive results, since no one would dream of giving a pilot recommendations that were not backed by experience. Yet flying experience sometimes developed faster than scientific theories, and an experienced pilot*

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▲
This MiG-21F coded '01 Red' is a different example (the zero is painted differently and there is no landing light on the nose gear unit). Note the open blow-in doors.

The same MiG-21F '01 Red' (c/n N72210206) on display at the Soviet Army Museum in Moscow. The BD3-58-21 wing pylons have been removed. Note the open airbrakes.
▼

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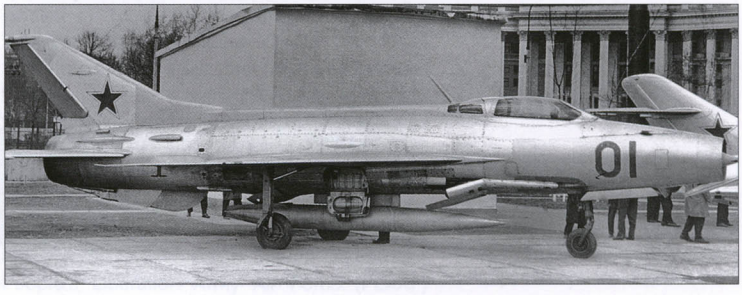

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KhAl

▶ **This MiG-21F coded '25 Red' served as a teaching aid at the Khar'kov Aviation Institute.**

Ken Duffey

▲ **This MiG-21F with the symbolic code '21 Blue' is on display at the aircraft museum in Lugansk, Ukraine. The air data boom is missing.**

might well have his own modus operandi *– accepting the full responsibility if his plan went wrong.*

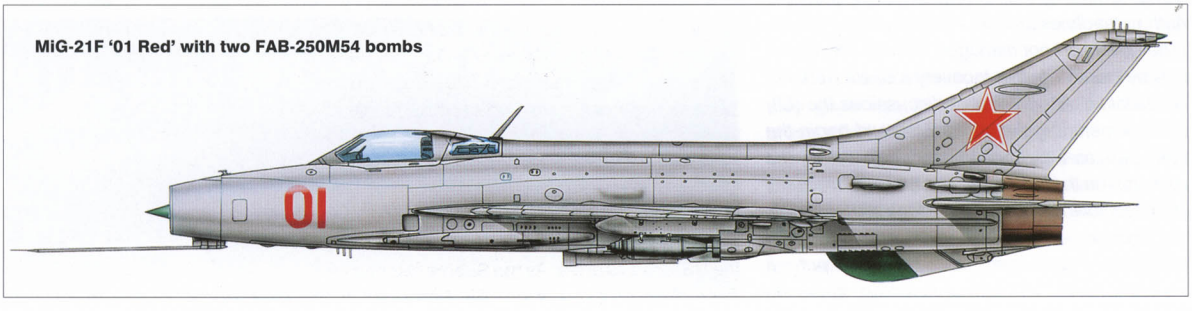
Well, in one of the flights the aircraft entered a flat spin – the stress kind of thing. It did not respond to the recommended control inputs and kept on spinning. Feeling sick at heart, I looked at the push-buttons marked "Left spin recovery" and "Right spin recovery" on the instrument panel. The buttons were there, but the rockets which they were supposed to activate were not. Meanwhile, the aircraft was plummeting earthwards with a 100 m/sec [19,680 ft/min] sink rate. I was already below the stipulated ejection altitude, and I was desperately short of altitude and time. Improvising, I made another attempt, using a technique that was not in the manual – and succeeded; the spin stopped, but at too low altitude. When the test equipment readouts were analysed, someone supposed that I had been using imperfect control inputs due to lack of experience. The highly experienced Anokhin was tasked with flying the next mission – with the spin recovery rockets already in place. Well, he ran into a flat spin on his first try, and again recovery by means of control inputs was unsuccessful; he had to resort to the rockets. Anokhin praised my actions highly. This incident showed clearly that the main result of the tests sometimes comes to light at the eleventh hour, not at the beginning of the programme. We may well say that both the [Mikoyan OKB] pilot and the TsAGI experts had been too hasty in their conclusions. It was also clear that starting the trials without the recovery rockets is a bad idea.'

As mentioned earlier, in addition to cannons the MiG-21F was armed with bombs and unguided rockets carried on underwing pylons. The MiG-21F's strike capability was tested at GK NII VVS between 25th June 1960 and 20th April 1961, using two production examples coded '01 Red' (c/n N72210206 – that is, *izdeliye* 72, plant No. 21, Batch 02, 06th aircraft in the batch) and '02 Red' (c/n N72210207). The latter aircraft was used concurrently to verify the new experimental KT-82 mainwheels equipped with smaller brake actuating rams and new FMK-11 cerametallic brake disks replacing the earlier FMK-8 disks. Both aircraft were fitted with BD3-58-21 pylons and BD3-55T shackles. The following air-to-ground weapon options were used during joint State acceptance trials:

- 212-mm (8.34-in) ARS-212M and 240-mm (9.44-in) S-24 heavy unguided rockets;
- 120-kg (264-lb) OFAB-100-120 HE/fragmentation bombs (*os**kol**ochno-foo**gahs**naya **a**via**bom**ba*);
- 250-kg FAB-250M-54 and FAB-250M-58 HE bombs (1954 and 1958 models);
- 500-kg FAB-500M-54 HE bombs;
- ZB-360 napalm tanks.

M. Kh. Khaliyev was appointed project test pilot for this programme, with V. K. Yefimov and N. V. Gorokhov as engineers in charge. In the course of the State acceptance trials the MiG-21F logged 50 hours in 114 flights.

MiG-21F '01 Red' with two FAB-250M54 bombs



Since the engine of MiG-21F c/n N72210206 consistently flamed out after ingesting exhaust gases from the ARS-212M rockets, the Mikoyan OKB hastily developed countermeasures. These included installation of a special valve in the fuel system which reduced the pressure in the fuel delivery line, throttling back the engine when the rockets were launched. The modified aircraft then made 25 flights involving salvo launches of S-24 rockets; these were performed in accordance with the test plan and the 'Plan of development work for the purpose of ensuring stable engine operation during rocket and S-13 missile launches' that had been endorsed by GKAT and the Air Force on 26th November 1956. The valves did their job well, allowing the MiG-21F's engine to run stably when the S-24 rockets were launched throughout the combat envelope – that is, at altitudes of 550-6,000 m (1,800-19,685 ft) and indicated airspeeds of 580-1,000 km/h (360-621 mph). True, on several occasions blast gas ingestion caused annoying 'buzzing' turbulence inside the inlet duct, but this did not lead to surge. No further launches of ARS-212M rockets were made because the Council of Ministers had decided to scrap the Ovod-M (ARS-212M) system.

With two S-24 rockets and the centreline drop tank, the MiG-21F's speed was restricted to 1,000 km/h IAS at altitudes up to 8,500 m (27,890 ft) and Mach 1.3 above this altitude. With rockets but no drop tank the limit was 1,100 km/h (683 mph) IAS at altitudes up to 8,300 m (27,230 ft) and Mach 1.4 at higher altitude. Effective range with rockets at 11,000 m (36,090 ft) was 1,090 km (677 miles) on internal fuel, increasing to 1,300 km (807 miles) with a drop tank. Stability and handling deteriorated slightly when rockets or bombs were carried, but were still quite acceptable. The pylons allowed the PU-12-40 launch rails for the rockets to be attached securely – and jettisoned safely in case of need.

The joint State acceptance trials showed that the proposed air-to-ground weapons options expanded the tactical fighter's combat envelope considerably; they were therefore recommended for service. In 1960 the AS-24 weapons system based on the S-24 rocket was officially included into the MiG-21F's range of weapons.

As standard, the production MiG-21F could carry two UB-16-57U rocket pods holding a total of 32 S-5K or S-5M 57-mm FFARs, or two S-24 HVARs on PU-12-40 launchers, or two 50-/100-/250-/500-kg bombs. The production aircraft has an empty weight of 4,819 kg (10,623 lb); the normal take-off weight in 'clean' configuration

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◄
MiG-21Fs on the flight line at a Soviet airbase. Note the modified air data boom with pitch/yaw transducer vanes.
▼◄

was 6,850 kg (15,100 lb), increasing to 7,320 kg (16,140 lb) with a 490-litre drop tank, and the maximum TOW with two 500-kg bombs was 8,376 kg (18,465 lb). The standard avionics fit included a PUS-36D weapons sequencing module (*pri**bor** oopravl**en**iya strel'**boy*** – fire control device), an R-800 communications radio, a KAP-2 autopilot, an ASP-5NV-U1 computing gunsight and an SRD-5M or SRD-5MN Baza-6 gun ranging radar. The production MiG-21F (*izdeliye* 72) with an R11F-300 engine delivering 3,900 kgp (8,600 lbst) dry and 5,750 kgp (12,680 lbst) reheat had a top speed of 1,200 km/h (745 mph) IAS at sea level and Mach 2.05-2,1 at high altitude. The service ceiling in level flight was 19,000 m (62,335 ft), the average take-off run 900 m (2,950 ft) and the landing run 800-1,000 m (2,620-3,280 ft). Rate of climb had deteriorated somewhat as compared to the prototypes, the production fighter requiring an average 8.9 minutes to reach 15,000 m (49,210 ft). The NATO reporting name was *Fishbed-C*.

K-13 Aircraft Weapons System
Ye-6T Tactical Fighter Prototypes

When the People's Republic of China and Taiwan (the Republic of China) clashed in armed conflict in 1958 (this became known as the Taiwan Crisis or China Crisis), on 24th September that year the Taiwanese pilots became the world's first fighter pilots to use air-to-air missiles in combat. The Taiwanese flew North American F-86F Sabres armed with AIM-9B Sidewinder infrared-homing short-range air-to-air missiles (AAMs); this missile was already quite widespread by then, being used by the USA and its allies. As the Sabres clashed with People's Liberation Army Air Force (PLAAF)

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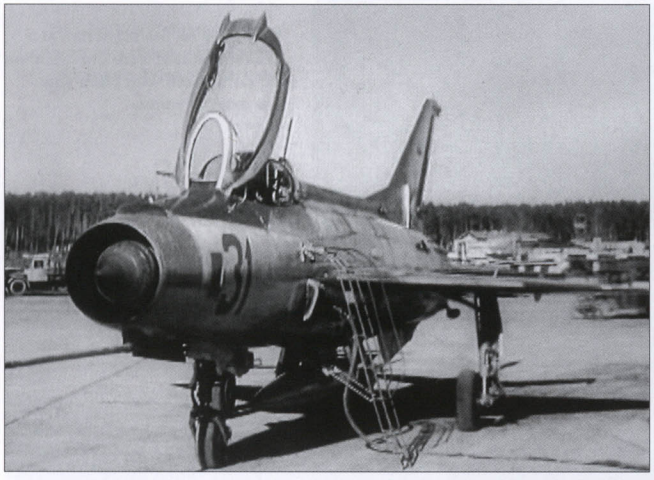
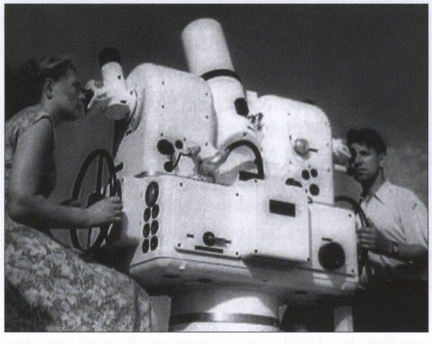
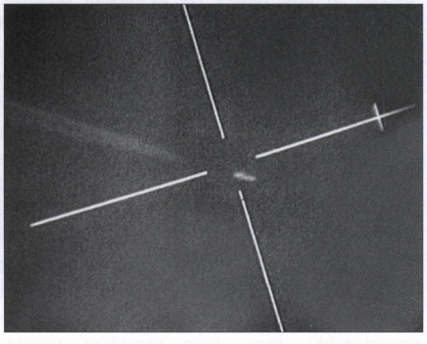


▲▲ ▲▲►
MiG-21F '31 Red' (c/n N72210301) was converted into the Ye-6T/1 (the first prototype MiG-21F-13). Here it is seen with the pylons removed for a speed record attempt; note the anti-glare panel and the tracer on the rear fuselage for visual tracking.



▲
Gheorgiy K. Mosolov climbs into the Ye-6T/1 for the record-breaking flight on 31st October 1959.

▲►
The Ye-6T/1 takes off past a row of Tupolev Tu-4 bombers.



►
A phototheodolite used during the record-breaking flights.

►►
The Ye-6T/1 seen through the crosshairs of the phototheodolite during the high-speed run.

Shenyang J-5s (Chinese-built MiG-17Fs) over the Strait of Taiwan and the coas of mainland China, at least one J-5 was shot down. Another J-5 took a direct hit but the warhead failed to detonate and the fighter came home with the unexploded Sidewinder *stuck in its fuselage*! Additionally, a few Sidewinders that missed their mark fell on Chinese territory, their wreckage being scattered over a huge area.

On learning of these developments the Soviet Union decided to obtain the captured AAMs for the purpose of studying them. In keeping with a Council of Ministers directive dated 13th November 1958 a group of 30 Soviet specialists was sent to China; it was headed by I. I. Toropov, Chief Designer of the OKB-134 weapons design bureau. On 28th November 1958 the Council of Ministers let loose with another directive (No. 1313-631) requiring plant

No. 134 hosting the OKB to copy the captured Sidewinder and put it into production. The Soviet version was designated K-13 or *izdeliye* 300.

Even a quick look showed that the Sidewinder was a lot different from the Soviet K-5M (alias RS-2-U) AAM in service at the time. The American missile's main distinguishing feature was that all components were packed tightly into the smallest possible airframe; while being comparable to the K-5M in all-up weight, the AIM-9 had a 50% smaller cross-section area, lacking the empty spaces characteristic of the Soviet weapon. Also, the Sidewinder had a different layout and a different control system, utilising passive IR homing instead of command link guidance, and relied on batteries rather than

RSK MIG

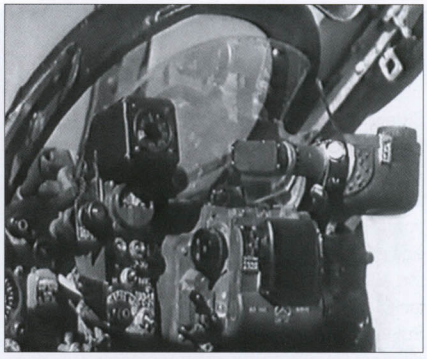
RSK MIG

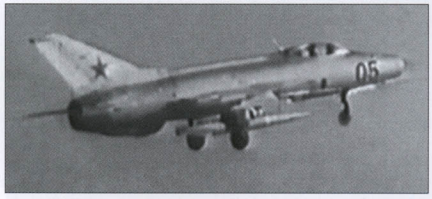
◄▲ **A MiG-21F-13 in early configuration. Note the original wing pylons with curved leading edges and the landing light attached to the nose gear unit. Early examples retained the narrow-chord vertical tail and the prominent canopy lock fairings.**

RSK MIG

◄ **One more view of the same aircraft, showing the K-13 AAMs on APU-13D launch rails. Again, grey walkways are painted on the wings.**

▶
MiG-21F-13 '05 Red' was one of the prototypes, as indicated by the camera pod under the port wingtip for capturing missile launches. Note the six mission markers on the nose denoting successful missile launches.
▶▼





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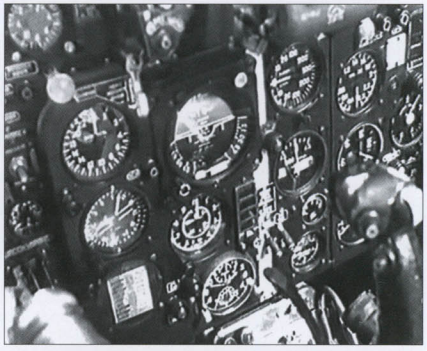
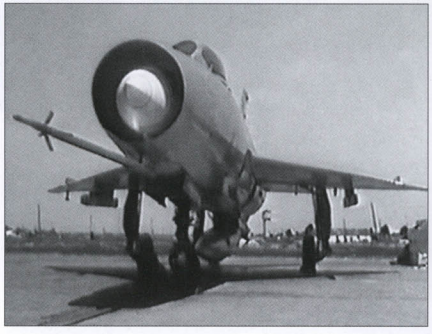
The MiG-21F-13's fixed bulletproof windscreen and ASP-5ND optical sight with gun camera.



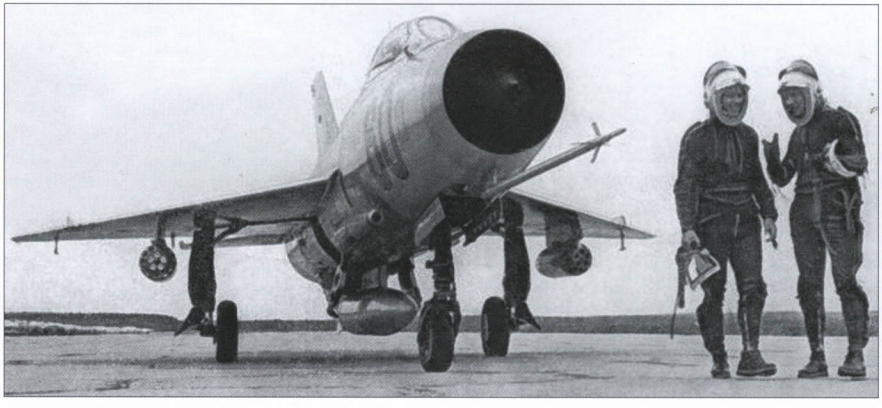
▶▶
The MiG-21F-13's instrument panel.

MiG-21F-13 pilots wore GSh-4M pressure helmets.
▶▶▼



▶▲
A MiG-21F-13 in flight in 'clean' condition.

▶
A MiG-21F-13 with APU-13D missile rails attached. Note the light-coloured air intake shock cone characteristic of early examples.



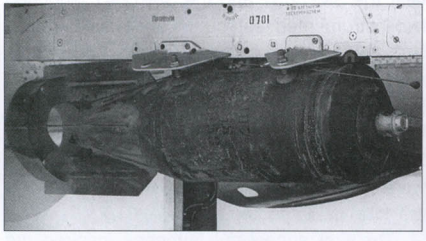
▶
A typical Soviet-era publicity photo of two jet fighter pilots in full attire discussing a successful mission in front of a MiG-21F-13 fitted with UB-16-57UM FFAR pods.

All photos Yefim Gordon archive

on a generator with a ram-air turbine for power supply.

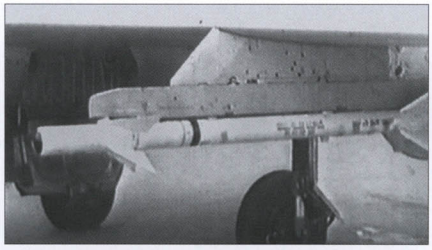
Reverse-engineering the Sidewinder's most important component – the IR seeker head – proved to be the greatest challenge. However, a team headed by Chief Designer D. M. Khorol stood up to the challenge; the Soviet copy of the seeker head was designated TGS-13 (*teplo**vaya** go**lov**ka **sa**monave**den**iya* – IR homing head). The tests began at a brisk pace. As early as March 1959, following a series of captive-carry tests, the Mikoyan SM-9/3T weapons testbed (a modified MiG-19) performed two drops of dummy *izdeliye* 300 AAMs and 12 launches in ballistic mode. Yet on 25th April 1959 the tests were suspended when a series of three launches for the purpose of testing the missile's self-destruct feature and five launches of instrumented test rounds against ground targets gave unsatisfactory results. Throughout the summer the design team concentrated on refining the seeker head and the control system servos' power supply.

Even then, in the early summer of 1959, the expediency of copying the AIM-9B was called into question; the 'anti-Sidewinder lobby' pointed out the poor performance demonstrated by the American missile during the Taiwan Crisis. Refuting these claims, GKAT Chairman Pyotr V. Dement'yev cited lack of experience on the part of the Taiwanese pilots and their sporadic use of



the missiles as the reasons for this poor performance in a report to Council of Ministers Vice-Chairman Dmitriy F. Ustinov. According to intelligence data available to the Soviet Air Force, a mere five Sidewinders had been fired during the hostilities.

Since the MiG-19 was being phased out of production at the time, it was decided to use the more advanced and promising MiG-21 as the missile platform for the K-13. The missile-armed interceptor version was designated Ye-7, while the aerial intercept system built around it was called MiG-21P-13, the P standing for *pere**khvaht**chik*** (interceptor). OKB-155 was instructed to verify the K-13 weapons system on two MiG-21s, which were to be converted to take the TsD-30 fire control radar and two K-13 AAMs; the fighters were to commence joint State acceptance trials in the fourth quarter of 1959. The TsD-30 radar was then undergoing trials on the aforementioned SM-12 development aircraft



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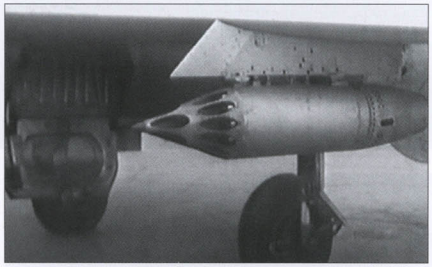
The port wing pylon of a MiG-21F-13 with an R-3S missile attached via an APU-13 launch rail. The production-standard pylons have straight leading edges.



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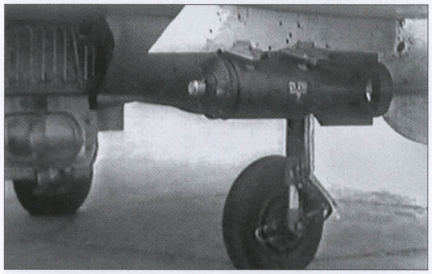
A sharp-nosed UB-16-57UMP FFAR pod on the port pylon of a MiG-21F-13.



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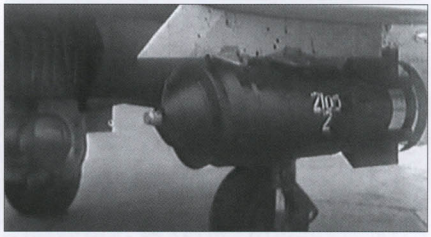
An FAB-100 HE bomb on the port pylon of a MiG-21F-13. Note the sway braces.



◄◄
Close-up of an FAB-100 on the starboard pylon of MiG-21F-13 c/n N74210701.

◄
An FAB-250 HE bomb on the port pylon of a MiG-21F-13.

A ZB-360 napalm tank on the port pylon of a MiG-21F-13.
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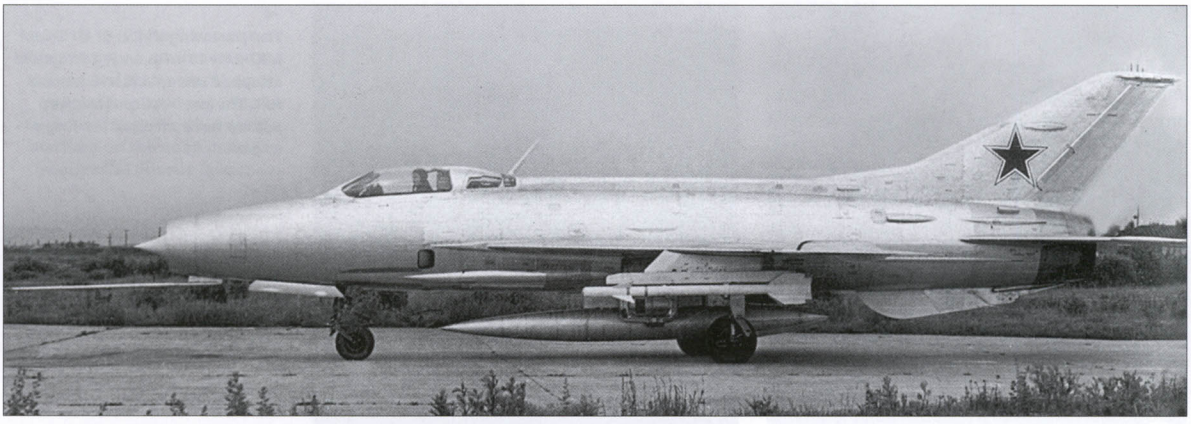

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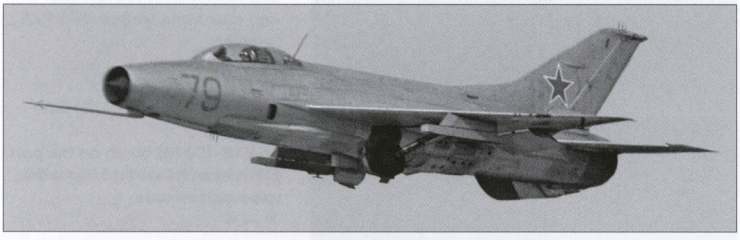

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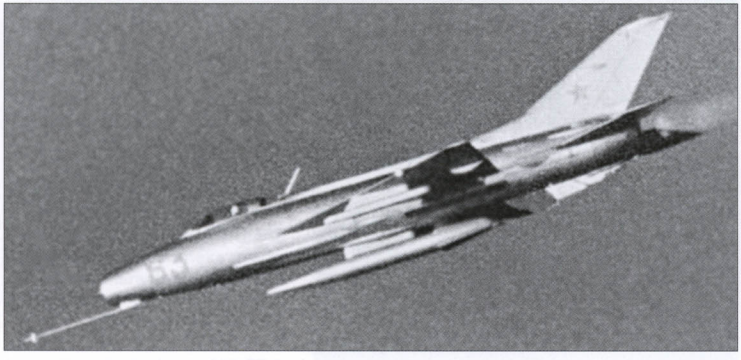

▲▲▲
An early-production MiG-21F-13.

▲▲ ▲
Production MiG-21F-13s on take-off and in cruise flight.

Soviet pilots run towards their early-production MiG-21F-13s during a practice alert.
▼

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(which was part of the SM-12-51 aerial intercept system) and the Sukhoi T-3 development aircraft, a precursor of the Su-9 interceptor (which was part of the T-3-51 aerial intercept system).

Since the manufacturer's flight tests of the Ye-7 interceptor designed to take the K-13 weapons system (see next chapter) were only just beginning in the autumn of 1959, the Mikoyan OKB decided to use several other aircraft as test vehicles for the new missile. These included the SM-12/3T equipped with the Kvant (Quantum) aerial intercept radar and the SM-12/4T fitted with the improved Kvant-1 radar. Additionally, a number of early-production MiG-21Fs were modified under this programme. One of them was MiG-21F '31 Red' (c/n N72210301), which was fitted with APU-13D missile rails and several other new equipment items, becoming the Ye-6T/1. Similarly, '32 Red' (c/n N72210302) was modified in the same manner to become the Ye-6T/2; a further aircraft wearing no tactical code (c/n unknown) was designated Ye-6T/3. The latter aircraft served as an equipment testbed, being used to verify the KAP-2 autopilot and later the KAP-3, among other things.

The first launch of a K-13 in guided mode did not take place until 21st October 1959; one of the SM-12s acted as the missile platform, attacking a parachute-retarded target. On 1st December that year the SM-12/3T and the SM-12/4T launched two instrumented test rounds and a live K-13 at a MiG-15M remote-controlled target drone (M = ***mishen'*** – target). Joint State acceptance trials of the K-13 weapons system began on 12th December, at which point the Ye-6T/2 joined the SM-12/3T and SM-12/4T. Five MiG-15M drones were shot down in the course of the trials, two of the 'kills' being scored by the Ye-6T/2.

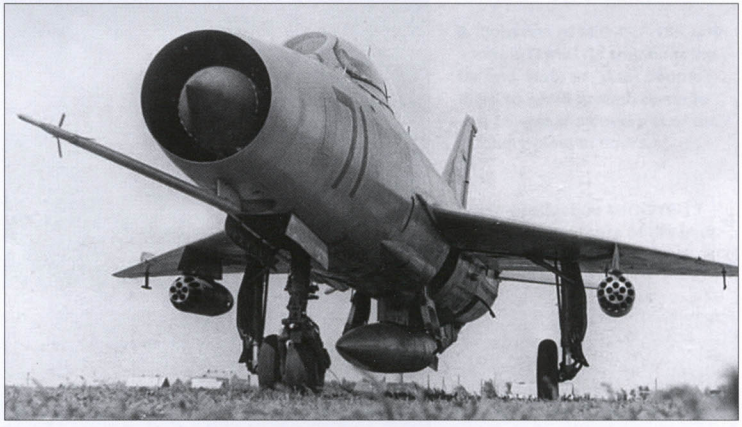
The first successful launches inspired the Council of Ministers to issue a directive in February 1960 ordering the K-13 missile into production at two plants – No. 43 in Moscow and No. 485 in Kiev. However, since the tests of the MiG-21P-13 aerial intercept system were running behind schedule, a decision was taken to equip the production MiG-21F with the same K-13 weapons system pending their completion.

MiG-21F-13 Tactical Fighter (Ye-6T, *izdeliye* 74, *Fishbed-C*)

As early as July 1960 the Gor'kiy aircraft factory completed an initial batch of Ye-6T missile-armed fighters; the new version bore the service designation MiG-21F-13 and the in-house product code *izdeliye* 74. The MiG-21F-13

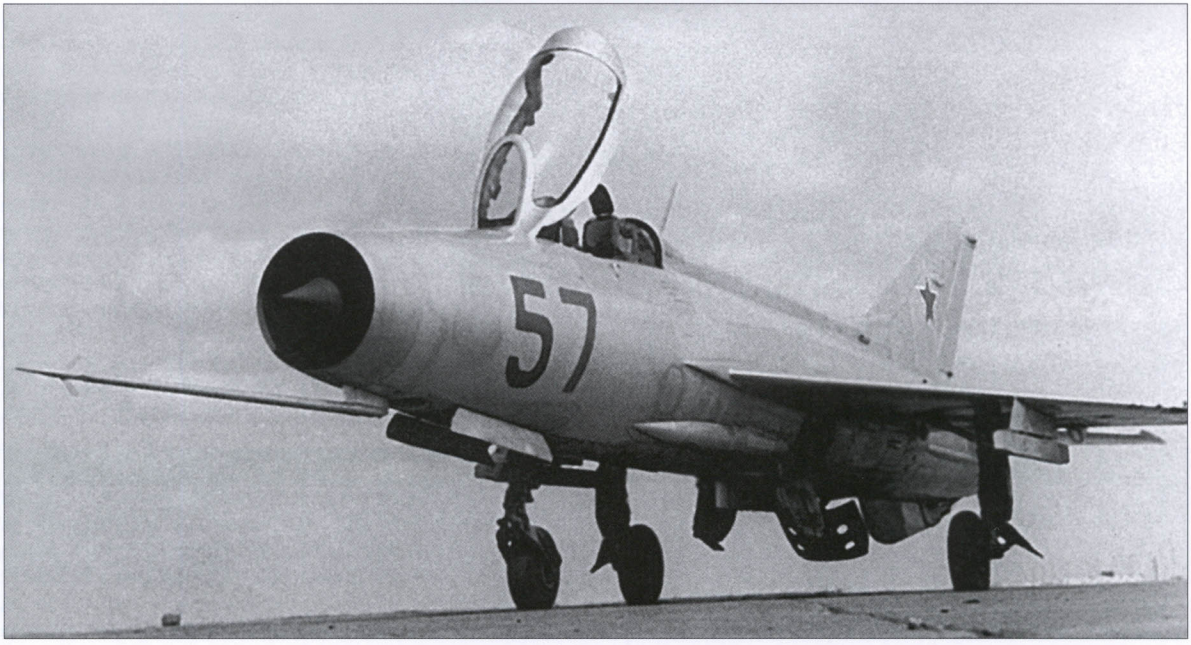
differed from the 'pure' MiG-21F primarily in lacking the portside cannon (this was a weight-saving measure); hence the ammunition supply was reduced to a mere 30 rounds. Early examples had APU-28 missile rails (replaced by

▲ **A late-production MiG-21F-13 coded '97 Blue' taxies past, showing the wider-chord vertical tail.**



▶ **A dramatic 'toad's eye view' of a MiG-21F-13 carrying UB-16-57U blunt-nosed FFAR pods.**

This view shows well the pointed fairing where the MiG-21F's port cannon was. Note the revised canopy lacking the lock fairings. ▼



All photos Yefim Gordon archive

Specifications of the MiG-21F-13.

Powerplant	Tumanskiy R11F-300
Thrust, kgp (lbst):	
at full military power	3,900 (8,600)
in full afterburner	5,750 (12,680)
Empty weight, kg (lb)	4,871 (10,738)
Normal take-off weight without drop tank, kg (lb):	
c/ns 74210701 through 74210814	7,100 (15,650)
from c/n 74210815 onwards	7,265 (16,020)
Normal take-off weight with drop tank, kg (lb):	
c/ns 74210701 through 74210814	7,570 (16,690)
from c/n 74210815 onwards	7,735 (17,050)
Maximum take-off weight with drop tank and two FAB-500 bombs (c/ns 74210701 through 74210814), kg (lb)	8,386 (18,487)
Landing weight without missiles and with 7% fuel reserves, kg (lb)	5,200 (11,460)
Internal fuel capacity, litres (Imp gal):	
c/ns 74210701 through 74210814	2,280 (501.6)
from c/n 74210815 onwards	2,480 (545.6)
Drop tank capacity, litres (Imp gal)	1 x 490 (107.8)
Maximum speed, km/h (mph):	
at full military power	1,300 (807)
in full afterburner	Mach 2.05
at 12,300 m (40,350 ft)	2,125 (1,320)
Landing speed, km/h (mph)	260-280 (161.5-174)
Service ceiling in level flight with K-13A AAMs, m (ft)	18,800-19,000 (61,680-62,335) *
Endurance at service ceiling, minutes	up to 6
Climb time (at full military power/in full afterburner), minutes:	
to 5,000 m (16,400 ft)	3.3/1.5 (with AAMs)
to 10,000 m (32,800 ft)	6.6/3.2-3.8 (with AAMs) *
to 13,000 m (42,650 ft)	8.9/n.a.
to 19,000 m (62,335 ft)	14.3/10.9-13.5 (with AAMs) *
Time to service ceiling, minutes	16.9 †
Rate of climb in full afterburner, m/sec (ft/min)	130-140 (25,580-27,550)
Maximum range at 11,000 m (36,090 ft) with AAMs, km (miles):	
on internal fuel only	1,400 (869)
with drop tank	1,670 (1,037)
Maximum endurance at 11,000 m (36,090 ft):	
on internal fuel only	1 hr 43 min
Take-off run in full afterburner, m (ft)	
'clean'	750 (2,460)
with AAMs	910 (2,985)
with AAMs and drop tank	1,580 (5,180)
Landing run, m (ft):	
with brake parachute	800-900 (2,620-2,950)
without brake parachute	1,200-1,300 (3,940-4,260)

The MiG-21F-13's speed and G limits with external stores

External stores	K-13 AAMs	FAB-250 bombs	FAB-500 bombs	PTB-490 drop tank
G limit	7	6	5	6
Mach limit	–	1.3	1.3	1.8

* Different documents give different figures

† The afterburner was switched off at 8,000 m (26,250 ft)

APU-13s on later batches); these were used for carrying K-13 IR-homing AAMs, which were subsequently replaced by the more advanced K-13A and R-3S derivatives. The missile rails were detachable, allowing the MiG-21F-13 to fly strike missions with the usual choice of air-to-ground weapons – two UB-16-57U rocket pods with S-5M or S-5K FFARs, two S-24 HVARs on PU-12-40 launchers, or two FAB-100/FAB-250/FAB-500 bombs or ZB-360 napalm tanks.

The MiG-21F-13 was equipped with an upgraded ASP-5ND optical gunsight and an upgraded SRD-5ND or SRD-5M ranging radar. The basic avionics suite also included an ARK-10 ADF, an RV-UM radio altimeter, an SRO-2 IFF transponder, an SOD-57 decimetre-waveband DME transponder (later replaced by the SOD-57M), an R-802 radio, a KAP-2 autopilot (late examples had a KAP-2K or AP-1 autopilot) and a PUS-36DM weapons sequencing module; provisions were made for installing an AFA-39 aerial camera (***aerofotoapparaht***). The fighter featured an SK ejection seat, the forward-hinged cockpit canopy acting as a slipstream deflector during ejection.

In 1960 plant No. 21 manufactured 132 production MiG-21F-13s, followed by 226 in 1961 and a further 15 in 1962. Various changes were introduced in the course of production. For instance, the first 134 production MiG-21F-13s retained the narrow-chord vertical tail of the basic MiG-21F with an area of 4.08 m^2 (43.87 sq ft). Later aircraft had a shorter vertical tail with a broader chord both at the root and at the tip; the area was reduced to 3.8 m^2 (40.86 sq ft). At the same time the canopy locking system was revised and the distinctive lock fairings on top of the canopy were eliminated.

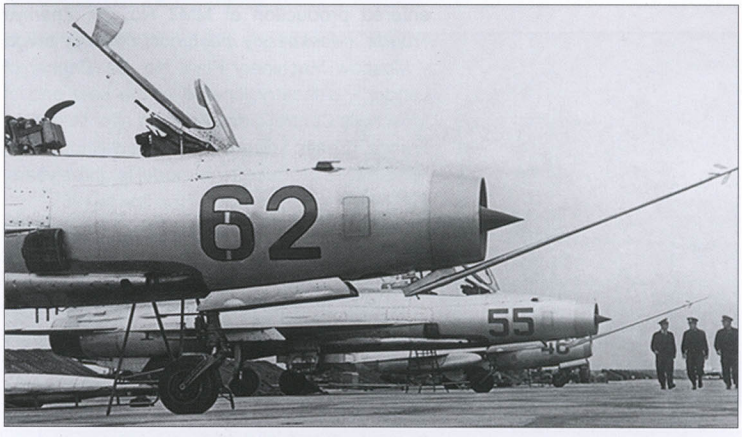
Interestingly, no State acceptance trials of the MiG-21F-13 were ever held and the performace (that is, maximum effective 'kill' range and so on) of its main weapon, the K-13 AAM, was not explored. This was because OKB-134 was already working on the improved K-13A having the specified 'kill' range, albeit the programme was suffering serious delays. Nevertheless, on 27th October 1960 the Council of Ministers issued directive No. 1133-476 officially including the new fighter into the Soviet Air Force inventory.

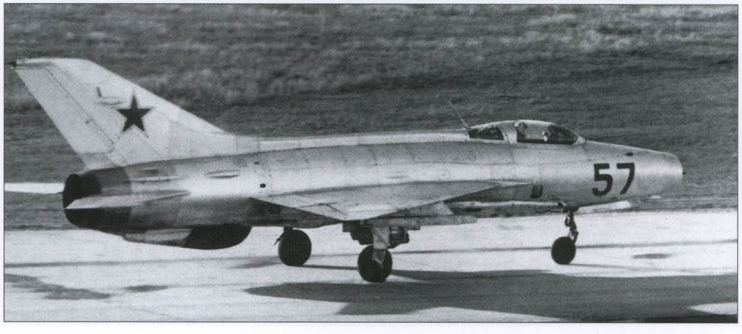
A formation of production MiG-21F-13s toting K-13 missiles took part in the Aviation Day air parade at Moscow-Tushino on 9th July 1961, making the type's public debut. After that the fighter received the NATO reporting name *Fishbed-C* (like the cannon-armed version), while the missile was code-named AA-2 *Atoll*.

◄
This view of MiG-21F-13 '97 Blue' shows the enlarged rear transparency of the revised canopy characteristic of late production examples. It also gives details of the wing and fuselage panel lines.

A flight line of MiG-21F-13s, with a lone UTI MiG-15 trainer at the far end. Note the pitot booms tilted to avoid ground damage and the ground covers over the auxiliary blow-in doors.
▼

A late-production MiG-21F-13 shows the contours of the new wide-chord vertical tail.
▼▼





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After completing its final MiG-21F-13s in 1962 the Gor'kiy factory switched to more advanced versions of the type. However, this was not the end of the road; that same year the MiG-21F-13 entered production at MMZ No. 30 *'**Zna**mya Troo**da**' (Mos**kov**skiy ma**shin**ostroi**t**el'nyy za**vod*** – Moscow Machinery Plant No. 30 'Banner of Labour'), a factory located at the east end of Moscow's Central airfield named after Mikhail V. Frunze (better known as Moscow-Khodynka). MMZ No. 30 produced this model for three years, the final example rolling off the line in 1965.

Apart from the Soviet Air Force, the MiG-21F-13 saw service with most of the Soviet Union's Warsaw Pact allies. Moreover, it was built under licence in Czechoslovakia (see next heading). Some of the export examples were fitted with the export model of the radar rangefinder designated SRD-5MK.

Czech-built MiG-21F-13 Tactical Fighter (Aero S-106, *izdeliye* 74, *Fishbed-C*)

Two of the Soviet Union's allies (the People's Republic of China and the Czechoslovak Socialist Republic) obtained licence manufacturing rights for the MiG-21F-13. Chinese production is described separately, since the Chinese started a new line of development with the MiG-21 and created their own versions having no Soviet equivalents. In Czechoslovakia the type was built by Aero at company's plant in Vodochody (pronounced *'Vodo**khody**'*) 20 km north of Prague. The Czech-built examples differed from their Soviet-built sister ships in lacking the small transparency aft of the hinged canopy.

Until the mid-1950s the Czechoslovak Air Force had a habit of allocating its own designations to foreign-designed and/or imported aircraft in Czech service. For example, the Messerschmitt Bf 109G was manufactured locally as the S-99, the S denoting *stíhací* [*letoun*] – fighter (a refined indigenous version was known as S-199); the Il'yushin IL-10M attack aircraft was built under licence by Avia as the B-33, the MiG-15 *Fagot-A*, MiG-15*bis* *Fagot-B* and UTI-MiG-15 *Midget* were built as the Aero S-102, S-103 and CS-102 respectively and so on. In keeping with this practice the Czech-built MiG-21F-13 was initially designated S-106. However, this designation was short-lived and rarely encountered.

Ye-6/2 and Ye-6/3 Development Aircraft

Upon completion of the State acceptance trials the Ye-6/2 ('22 Red') and the Ye-6/3 ('23 Red') found further use in two test programmes described below. Both aircraft were returned to the Mikoyan OKB's prototype construction facility, which fitted them with underwing APU-13 missile rails replacing the BD3-58-21 pylons; the missile rails were used for carrying dummy K-13 AAMs. The purpose of the first research and development programme in which the two fighters participated was to explore the MiG-21F's stability and handling with the missiles in various locations on the wings and determine the optimum location.

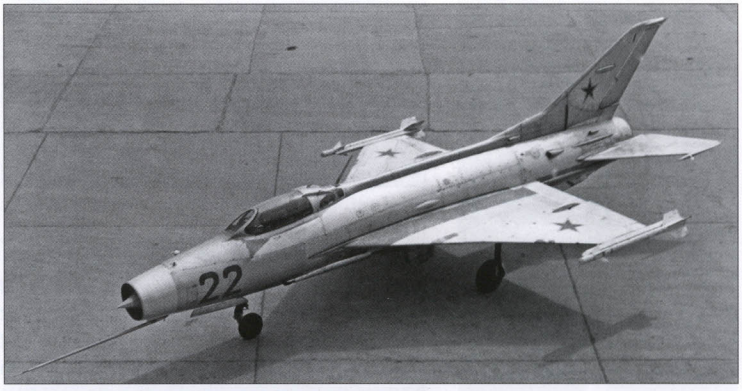
Four configurations were used. The first was 'clean' (without external stores) and retained the standard wingtips; the second featured underwing missile carriage (as on the MiG-21F-13) and again had normal wingtips. The third version had the APU-13 missile rails at the wingtips in a manner similar to some Western fighters but was flown without the actual dummy missiles, which were fitted in the fourth configuration.

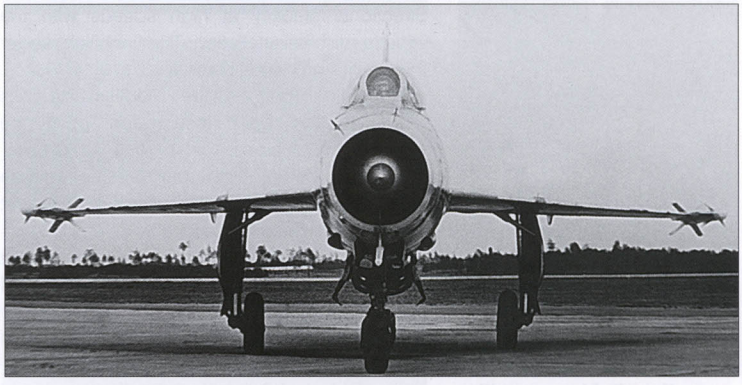
Only the Ye-6/2 had the wingtip missile rails, being thus modified after flying several sorties with the underwing missile installation; the modified aircraft arrived at the Mikoyan OKB's flight test facility in Zhukovskiy on 1st September 1960. The conversion included the following. The area of the detachable wing panels was increased by 0.8 m² (8.6 sq ft) by extending the leading edge outboard of rib 12 to create a double-delta shape. The leading-edge sweep on the outer wing portions was reduced from 57° to 48°, while the tip chord was increased from 450 mm (1 ft 5$^{23}/_{32}$ in) to 1,200 mm (3 ft 11¼ in) to enable installation of the APU-13 missile rails the latter were attached in the wing chord plane. When the missile rails were not fitted, their attachment fittings were enclosed by wingtip fairings.

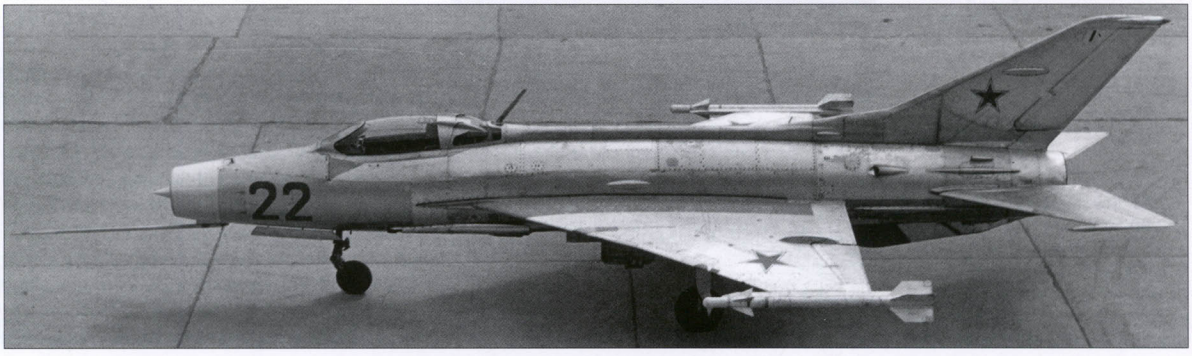
Konstantin K. Kokkinaki flew the modified fighter, with V. Ya. Shcheblykin as engineer in charge. For two weeks after arriving at Zhukovskiy the Ye-6/2 was in lay-up while ground checks and modification work were in progress; it finally made its first post-conversion flight on 14th September. The required clearance to begin test flights with the missiles at the wingtips could not be obtained for a long time, causing an interruption in the tests until 26th October.

Between 16th February and 17th March 1961 the Ye-6/2 was test flown with a new variable engine nozzle featuring two petals or 'eyelids'. This proved rather troublesome and required a lot of debugging, as the aircraft would yaw sharply due to asymmetric thrust when the afterburner was ignited; repeated adjustment of the nozzle petals was of no avail, and eventually the standard afterburner/nozzle assembly had to be reinstated. An unscheduled engine change had to be made on 27th March due to engine trouble. By 18th April 1961 (the day when the tests ended) the modified Ye-6/2 had made 29 flights, including four sorties in order to test and adjust the engine and 25 under the two test programmes (the choice of the best location and tests of the wingtip missile rails). It should be noted that the wingtip missile installation was tested first and foremost with the Ye-152 heavy interceptor in mind (this aircraft, a successor to

Three views of the Ye-6/2 ('22 Red') with modified double-delta wings and wingtip APU-13 missile rails. Dummy K-13 AAMs are fitted in this case.
▼







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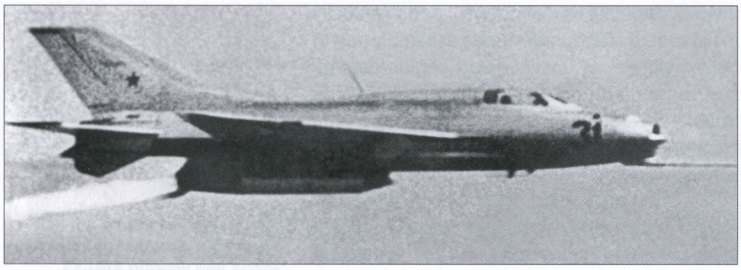
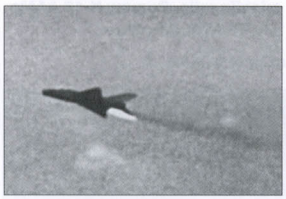
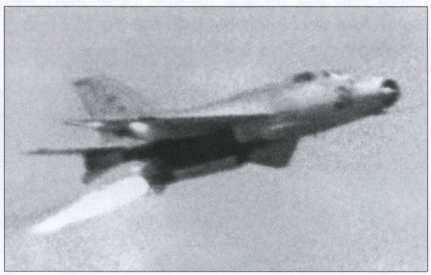
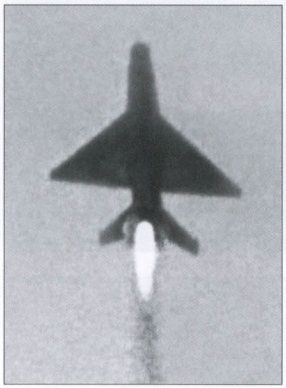








▲▲▲
The Ye-6T/1 in modified form (known to the FAI as the Ye-66A) with a ventral U-21 liquid-fuel rocket booster pack and a fat fuselage spine housing a fuel tank. The latter was similar to the later MiG-21PF.

▲ ▲►
More views of the Ye-6T/1 in action, climbing away with a sheet of flame from the rocket booster.

the Ye-150, was under development at the time), the MiG-21 being accorded lesser importance.

On 15th June 1961 the MiG-21's project chief A. G. Broonov sent a letter to the OKB's flight test facility, ordering the beginning of a new test programme. This involved flights at up to Mach 2.15 for the purpose of exploring the MiG-21's directional stability at high speeds with the wingtip missile installation. The final flight under this programme took place on 31st July 1961.

The final part of the modified Ye-6/2's manufacturer's flight test report gave the following conclusions:

- the Ye-6/2 with the wingtip missile installation displays adequate lateral stability at speeds up to Mach 2.08;
- Mach buffet at transonic speeds arises at lower G loads as compared to the standard fighter;
- airflow departure intensifies the Mach buffet, which is accompanied by sharp yawing;
- at Mach 1.9 the Ye-6/2 with the wingtip missile rails shows better lateral stability than the Ye-6/3 with the underwing missile rails;
- with the wingtip missile rails the Ye-6/2 has better acceleration than prior to conversion (with underwing missile rails);
- the sustained service ceiling of the modified aircraft with the underwing carriage of K-13 missiles is 18,000 m (59,055 ft) versus 19,000 m (62,335 ft) for the production MiG-21F-13;
- the modified aircraft with the wingtip missile installation has a slightly higher service ceiling of 18,300 m (60,040 ft).

Konstantin K. Kokkinaki wrote in his report that he had made 23 flights in the modified Ye-6/2. He assessed the fighter's field performance as virtually unchanged, noting that directional stability had improved marginally as compared to the underwing missile installation.

The final verdict was that introducing the wingtip missile installation on the production MiG-21 was inexpedient after all. Since the tests had failed to show a positive effect of such an installation on the MiG-21, it was necessary to test the wingtip missile rails on other fighter types.

The flight test report concerning the modified MiG-21F (Ye-6/2) with the wingtip missile installation was endorsed by OKB-155 General Designer Artyom I. Mikoyan on 28th December 1961. The wingtip missile rails found use on the Ye-152 experimental heavy interceptor and, later, on the Ye-152P.

Ye-6T Development Aircraft with R11F2-300 Engine (Ye-66)

Upon completion of the trials the Ye-6T/1 prototype ('31 Red') was progressively modified for the purpose of setting a series of world speed and time-to-height records. For starters, the aircraft was stripped of cannon armament and certain equipment items to cut the empty weight, and a new R11F2-300 engine was installed. This engine had a new two-stage afterburner operating algorithm; in the second afterburner mode the HP stage was spooled up to 105% of the nominal speed. On 31st October 1959 Mikoyan OKB test pilot Gheorgiy K. Mosolov set a speed record in this aircraft; the machine averaged 2,388 km/h (1,483 mph) on a 15/25-km (9.31/15.52-mile) course, accelerating to a maximum of 2,504 km/h (1,555 mph). This record was officially recognised by the Féderation Aéronautique Internationale (FAI), the aircraft being referred to in the documents submitted to the FAI as the 'Ye-66' to avoid revealing the true designation.

On 16th September 1960 Konstantin K. Kokkinaki established a new world speed record in the Ye-66, averaging 2,148.66 km/h (1,334.57 mph) over a 100-km (62.1-mile) closed circuit; the aircraft attained a top speed of 2,499 km/h (1,552 mph) on this occasion.

Ye-6T Development Aircraft with R11F2-300 Engine and U-21 Rocket Booster (Ye-66A)

That same year the Ye-6T/1 (Ye-66) underwent further modifications to adapt it for an attempt on the world altitude record. Firstly, a U-21 rocket booster (U = *ooskorite*l' – booster) was installed in a fairing under the rear fuselage. The U-21 was based on the Sevrook S3-20M5A liquid-fuel

rocket motor (c/n 0050759); this was developed by OKB-2, an organisation within the State Committee for Defence Equipment (GKOT – *Gosoo**dar**stvennyy komi**tet** po obo**ron**noy **tekh**nike*, formerly the Ministry of Defence Industry). Unlike some rocket boosters that used up their service life 'in one fell swoop', the S3-20M5A could be run several times.

The installation of the booster necessitated a whole raft of other changes. Ballast was installed in the fuselage nose in order to maintain a CG position of about 30% mean aerodynamic chord at maximum speed. The booster was installed on the centreline, hence the single ventral fin had to be replaced with two splayed fins whose total area amounted to 11.5% of the wing area. The vertical tail area was increased to 4.44 m^2 (47.74 sq ft) and the fin was fitted with a new sharp leading edge. A 170-litre (37.4 Imp gal) auxiliary fuel tank was installed in the bay aft of the cockpit, creating a big fat fuselage spine similar to that seen on later versions of the MiG-21.

The cruise engine was an R11F2-300 (c/n 717). It was rated at 3,746 kgp (8,258 lbst)at full military power, 6,184 kgp (13,633 lbst) in the first afterburner mode and 5,676 kgp (12,513 lbst) in the second afterburner mode.

In March 1961 the Ye-6T/1 was prepared for testing in this mixed-power version. Again, Gheorgiy K. Mosolov was project test pilot, with A. S. Izotov as engineer in charge. Since the second afterburner mode was still untried, the first afterburner mode was chosen as the main one for the record attempt. On 28th April Mosolov succeeded in attaining an altitude of 34,714 m (113,891 ft) in a zoom climb, beating the previous world record set by D. Jordan in a modified Lockheed F-104 Starfighter by 2,899 m (9,511 ft). The climb was initiated at 13,800 m (45,725 ft) and Mach 2.18; the cruise turbojet 'suffocated' and flamed out when the aircraft reached 22,500 m (73,820 ft) and the climb continued on the thrust of the rocket booster. The aggregate propulsive burn was 117,000-120,700 kg/sec (257,940-266,090 lb/sec).

As it reached the apogee, the aircraft started to roll slowly, tending to flick into an inverted spin, which the pilot prevented by taking corrective action. The rocket motor ran for 31.5 seconds. According to Mikoyan OKB estimates, the Ye-6T/1 equipped with the U-21 booster could have climbed even higher.

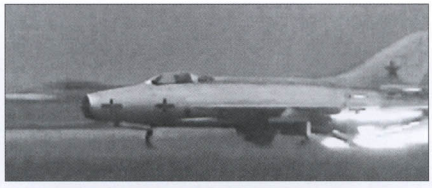
The new absolute world altitude record was duly documented by the FAI. In the FAI papers the mixed-power Ye-6T/1 appeared as the 'Ye-66A'.

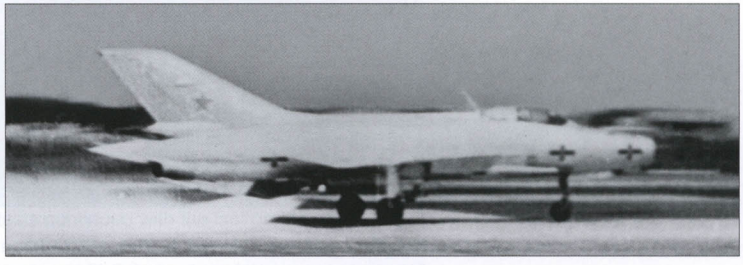
Like the standard MiG-21F-13, the record-breaking Ye-6T/1 (Ye-66A) participated in the Tushino air parade on 9th July 1961. Its performance wowed the many spectators, including the foreign military attachés who invariably attended such events. Instead of simply making a high-speed pass the aircraft ignited the rocket booster over the airfield and pulled up into a steep climb, vanishing from view... 'up, up and away'.

General Designer Artyom I. Mikoyan endorsed the report on the zoom climb tests of the mixed-power Ye-6T/1 (with the R11F2-300 c/n 717 and the U-21 rocket booster) on 18th September 1961.

Ye-6/9 Nuclear-Capable Experimental Fighter

A single production MiG-21F known at the OKB as the Ye-6/9 was experimentally given nuclear strike capability. The fuselage was modified, allowing the aircraft to carry a small Type 244 tactical nuclear bomb on the centreline on a BD3-55T shackle. The Ye-6/9 was equipped with a PBK-1 bomb sight optimised for the lob-





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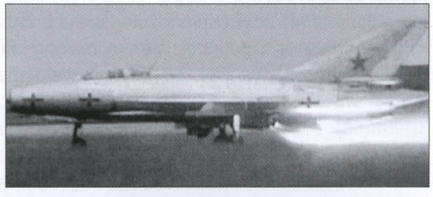

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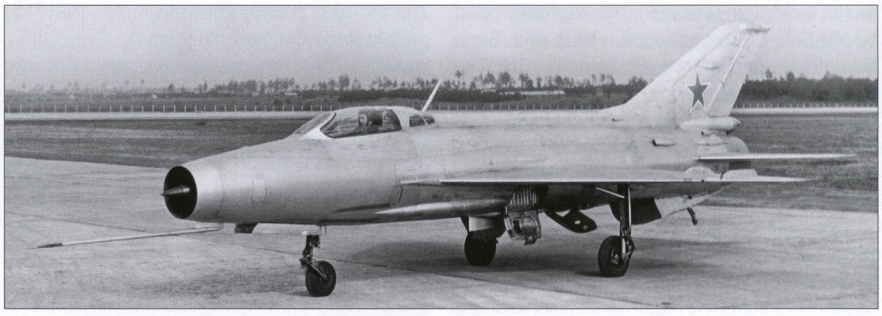
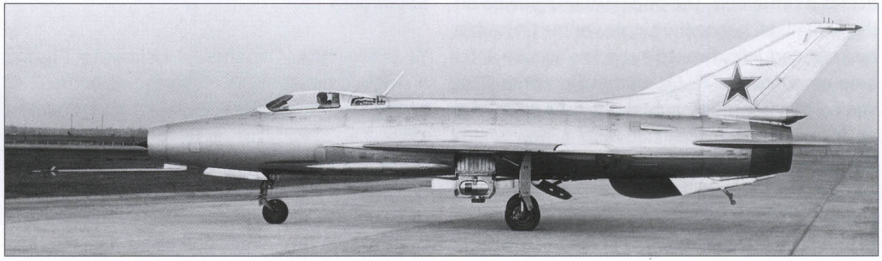
The Ye-6V/1 takes off with the help of two SPRD-99 solid-fuel rocket boosters. Note the wide-chord fin, the brake parachute housing at the base of the rudder and the cruciform photo calibration markings.





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The Ye-6V/2 was converted from an early MiG-21F-13, combining the old canopy (with lock fairings) with the new wide-chord tail. Note the traces of the port cannon's blast plate.
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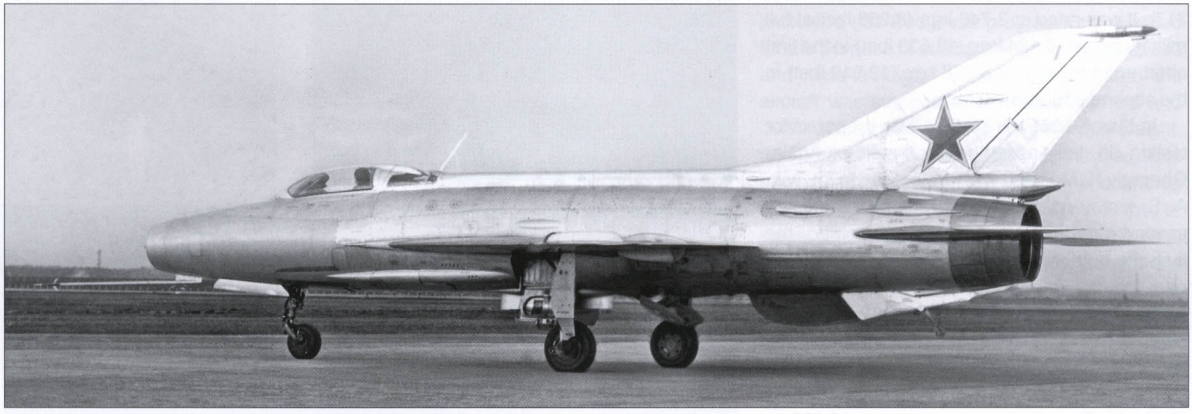
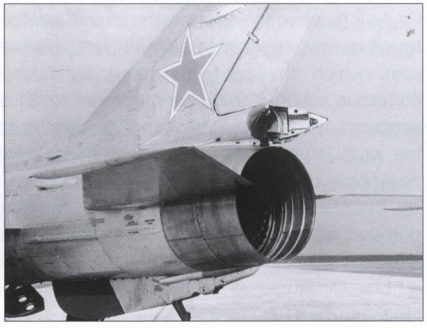


All photos RSK MIG

bombing delivery technique that allowed the fighter to approach the target covertly at ultra-low altitude, then zoom up and release the bomb in the middle of a half-loop before making off (PBK = *pri**tsel** dlya **bom**bome**tah**niya s kab-**ree**rovaniya* – bomb sight for bomb delivery in a climb). Bomb aiming in level flight or in a dive was also possible by means of the standard ASP-5ND sight.

The Ye-6/9 underwent tests in 1960-61.



►
Close-ups of the Ye-6V/2's rear end with the brake parachute container doors closed and open. Note the tail bumper protruding from the ventral fin.

Ye-6V Experimental Fighter (*Fishbed-E*)

In 1961 OKB-155 was tasked with developing a short take-off and landing (STOL) version of the MiG-21F-13 having a take-off and landing run of no more than 300-350 m (990-1,150 ft); the fighter was to be submitted for State acceptance trials in the third quarter of the year. That year the Mikoyan OKB's experimental production facility modified two production MiG-21F-13s, which were designated Ye-6V/1 and Ye-6V/2 (c/n N74210301). These fighters served as testbeds for a number of features intended to give them STOL capability – namely SPRD-99 jet-assisted take-off (JATO) boosters (*izdeliye* 314-2; SPRD = ***star****tovyy porokho****voy*** *ra****ket****nyy* ***dvig****atel'* – solid-fuel take-off rocket motor), a boundary layer control (BLC) system for the flaps and a brake parachute relocated to a cigar-shaped housing at the base of the rudder. Additionally, the Ye-6V featured a new wide-chord vertical tail.

The blown flaps underwent State acceptance trials with good results in 1961, whereupon the Mikoyan OKB decided to incorporate this feature on all subsequent versions of the MiG-21. The BLC necessitated installation of a modified engine featuring air bleed valves; this engine entered production as the R11F2S-300, the S referring to *sdoov pogra****nich****novo* ***sloy****a* (boundary layer blowing). The air was bled from the third and final high-pressure compressor stage, fed to the wings and distributed via slots along the leading edges of the flaps; the latter were set at 45°. The BLC system was activated automatically when the flaps were deployed past 30°.

In order to conduct further research into boundary layer control on the wing, aileron and stabilator leading edges and enhance the efficiency of the blown flaps, the Mikoyan OKB made the following modifications to the Ye-6V/1 in 1961. New hinged (that is, non-area-increasing) flaps with a maximum deflection in excess of 45° were fitted; air was supplied to the flaps via manifolds with three slots along each flap's leading edge. The wing leading edges were fitted with boundary layer blowing manifolds and outlets. The maximum stabilator travel was increased to 30-35° and the leading edges were likewise fitted with boundary layer blowing manifolds and outlets.

During the Aviation Day air parade at Moscow-Tushino on 9th July 1961 the Ye-6V/2 demonstrated a short take-off from Tushino's grass runway, assisted by SPRD-99 JATO boosters. This fact did not go unnoticed and the Ye-6V received a separate NATO reporting name, *Fishbed-E*.

◄

The Ye-6V/2 is prepared for a demo flight at Moscow-Tushino during an air show on 9th July 1961.

◄ ▲

The Ye-6V/2 takes off from the grass runway at Moscow-Tushino.

◄ ▼

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The test programme suffered a setback on 10th January 1962 when the Ye-6V/2's port JATO booster exploded on take-off, causing a massive fire that extensively damaged the aircraft. The tests continued with the first prototype.

In 1963 the Ye-6V/1 was retrofitted with an improved BLC that reduced the approach speed and landing run dramatically and enhanced the ailerons' efficiency. After being verified on this aircraft the system became a standard feature on production MiG-21s. In July 1963 the same aircraft was used in a brief test programme to explore the possibility of landing with angles of attack up to 16-18° (the MiG-21F's operational AoA limit was 10-11°) and determine the aircraft's landing performance with a specially fitted retractable tail bumper. The sprung tail bumper with a roller at the end was housed in the ventral fin. The BLC was deactivated for the duration of this programme. Mikoyan OKB test pilot Pyotr M. Ostapenko made four landings in this aircraft; a further two flights were performed by Aleksandr V. Fedotov.

▶
The Ye-6V/2 with two dummy K-13 AAMs and a drop tank.
▶▼

▶
Three-quarters rear view of the Ye-6V/2, showing the SPRD-99 JATO boosters.

▶
Close-up of the port SPRD-99 booster on the Ye-6V/2.

All photos RSK MiG

Landings performed with an AoA of 14° (with 25° flap) and an AoA of 16°30' (with the flaps up) showed that the aircraft was fairly stable around all three axes and displayed adequate aileron and rudder authority. With the tail bumper extended, the Ye-6V could land smoothly with these high AoAs. In a flapless landing with an AoA of 16°30', the fighter touched down at 244-251 km/h (151-156 mph); with 25° flap and an AoA of 14°, the touchdown speed was 256 km/h (159 mph).

The pilots noted that stabilator authority was insufficient during these high-AoA landings. Also, the unusually strong nose-up attitude and high position of the cockpit above the ground in these conditions complicated the landing approach, demanding special skill and concentration on the part of the pilot. The report also said that the fighter's longitudinal stability was insufficient at certain CG positions (for example, 37.5% MAC), which also made it harder to fly the aircraft.

The report described the tail bumper's shock absorber as adequate; when the Ye-6V/1 touched down tail first, settling down on the mainwheels a few seconds later, no sharp jolts were experienced. Aileron authority remained adequate right down to 230-240 km/h (142-149 mph).

Of the six high-AoA landings mentioned above, only one involved the use of flaps. With 25° flap and the control stick pulled all the way back, the aircraft touched down with a smaller angle of attack at 240 km/h. Similar experiments involving high-AoA landings were later undertaken with the Ye-7/3 and Ye-7/4 prototypes (see next chapter); interestingly, the Ye-7 touched down at the same speeds with no danger of tailstrike in these conditions. During landing approach the Ye-6V/1 glided at 320-350 km/h (198-217 mph); the holding-off was initiated at 3-4 m (10-13 ft) above the ground, which was higher than on the standard MiG-21F. The pilots noted that the touchdown with the tail bumper was always unexpected, the pilot perceiving the mainwheels to be about 0.5 m (1 ft 7 in) above the ground at that moment. After rolling along the runway on its tail bumper for a second or two the aircraft would settle down smoothly on the mainwheels and then drop the nosewheel.

The landing weight of the Ye-6V/1 during these tests varied from 5,450 to 5,850 kg (12,015-12,900 lb). The following table details the test results obtained during the high-AoA landings with the tail bumper.

The verdict of the test pilots and test engineers was unanimous and clear: the high-AoA landing technique making use of the tail bumper was complicated and harder to master for service pilots than the technique making use of blown flaps.

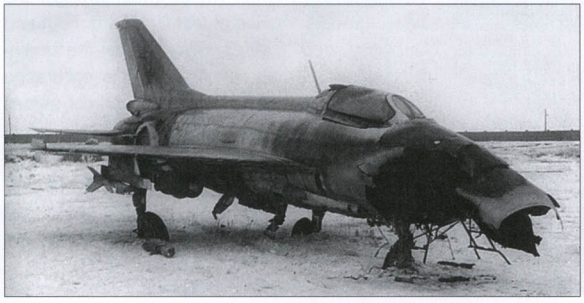
Ye-6T/2 Landing Gear Testbed

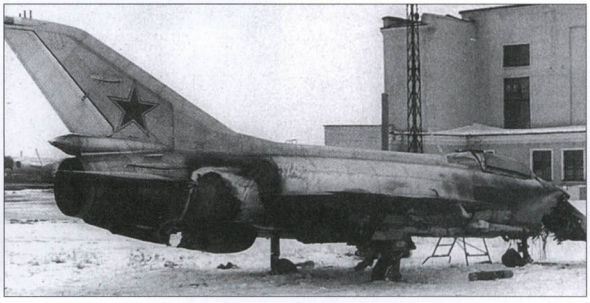
When the trials of the K-13 weapons system had been completed, the Ye-6T/2 prototype found further use as a test vehicle. In 1961 this aircraft

High-alpha test results obtained with the Ye-6V/1

Date	Landing speed, km/h (mph)	Landing run, m (ft)	Stabilator deflection	Flap setting
04.07.63	256 (159)	1,387 (4,550)	29°	25°
04.07.63	n.a.	n.a.	n.a.	0°
09.07.63	258 (160)	716 (2,349)	29°	0°
09.07.63	244 (151)	578 (1,896)	28.6°	0°
19.08.63	260 (161)	1,045 (3,428)	24.4°	0°
21.08.63	251 (156)	925 (3,034)	29°	0°

The Ye-6V/2 after the booster explosion on 10th January 1962. The extent of the damage is clearly visible.
▼◄ ▼





TsGANKh

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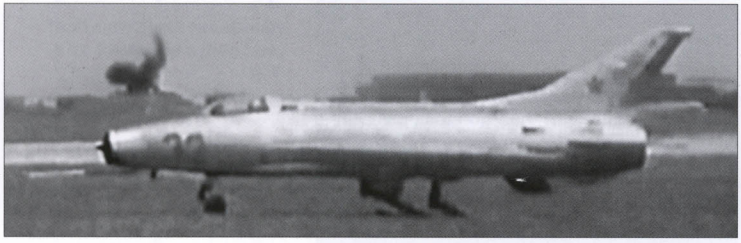
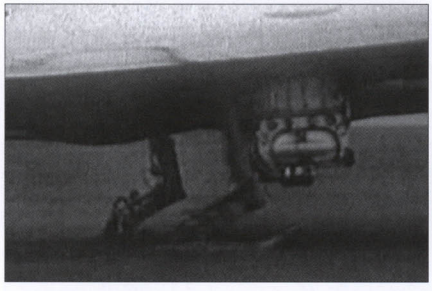


▲ **The Ye-6T/2 after conversion as a landing gear testbed with special levered suspension main units fitted with skids.**



►▲ **This sequence of stills from a ciné film shows the modified Ye-6T/2 taking off from the dirt strip at Zhukovskiy.**

was fitted with a non-retractable skid landing gear for operations from dirt strips; rectangular and circular skids were tried out. The tests took place at Tret'yakovo airfield near Lookhovitsy, Moscow Region, involving 18 taxi runs and 11 flights. Before that, the Mikoyan OKB had undertaken a similar research programme with the Ye-5 (see previous chapter).

Ye-6T/3 Control Configured Vehicle

Once the KAP-2 autopilot had been put through its paces on the Ye-6T/3, the aircraft was refitted with the new KAP-3 autopilot; the latter passed its tests with good results in September 1963 and was cleared for production as the AP-155. Even as the KAP-2 was being tested, the aircraft was fitted with movable canard foreplanes (called 'destabilisers' in Russian terminology of the time) on the sides of the extreme nose; thus the Ye-6T/3 can be regarded as a control configured vehicle (CCV). The canards were locked neutral before the aircraft went supersonic.

Other changes included removal of the port cannon and ammunition box in order to provide room for an extra 140 litres (30.8 Imp gal) of fuel. The RSIU-4V *Min**dahl'*** (Almond) radio was replaced with a more modern RSIU-5 Doob (Oak) radio.

The CCV was tested in 1961-62 as part of the efforts to create two very different aircraft – the Ye-8 interceptor derived from the MiG-21 (see Chapter 6) and the Ye-152P heavy interceptor. A total of 58 flights had been made when the programme was completed in July 1962.

MiG-21F-13 Unpaved Strip Operations Teastbed

A production MiG-21F-13 coded '01 Red' (c/n unknown) was modified under a research programme concerned with tactical fighter operations from semi-prepared airstrips. The rear transparency of the cockpit canopy was replaced with sheet metal and the pitot boom was located dorsally on the centreline instead of ventrally to minimise the risk of foreign object damage. Retaining the normal wheel undercarriage, the aircraft made a series of test flights from dirt and snow-covered airstrips. Shortly after the beginning of these trials, phototheodolite calibration markings in the form of sets of vertical stripes were applied to the airframe to assist measurements and calculations.

The dorsally mounted pitot became a feature of all subsequent MiG-21 variants. As noted earlier, the lack of the rear transparency was characteristic of the Czech-built MiG-21F-13s.

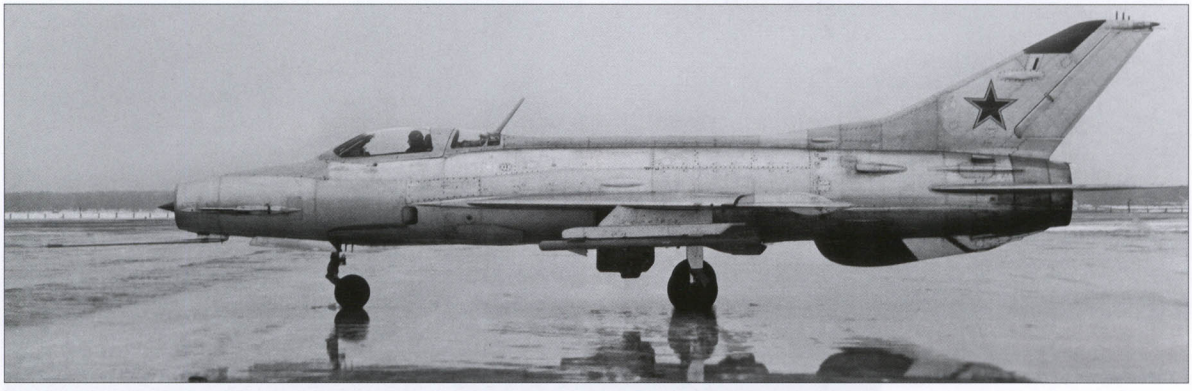
MiG-21F-13 PSP Strip Operations Testbed

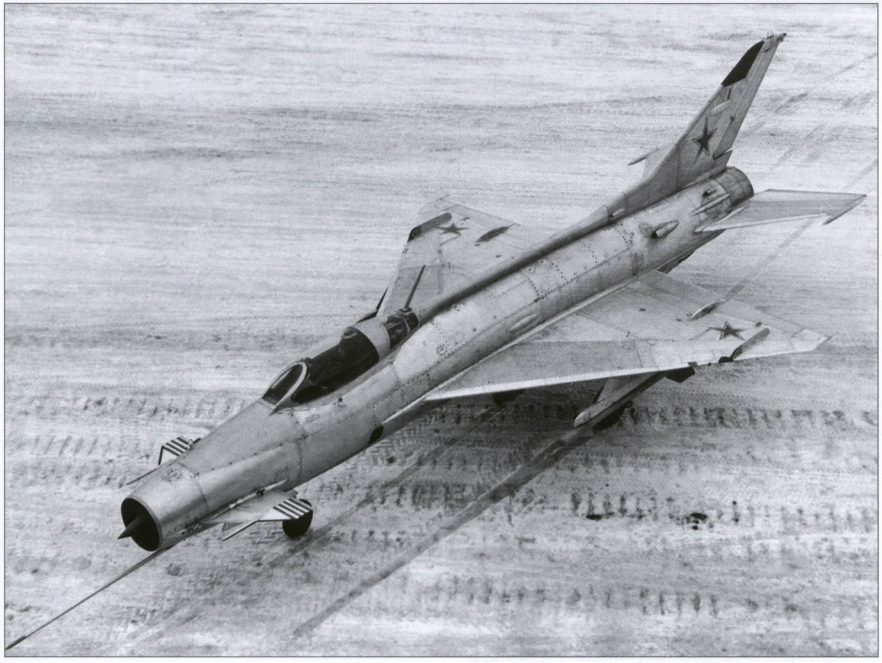
As part of the same research programme, in the early 1960s another production MiG-21F-13 coded '12 Red' (c/n unknown) was used to explore the possibility of fighter operations from ad hoc tactical airstrips paved with perforated steel plate (PSP).

All photos RSK MiG

▶ **Front view of the Ye-6T/3 after conversion as a CCV with canard foreplanes. As this view shows, the canards were mounted belowthe air intake axis and the wing plane.**

Side view of the Ye-6T/3 CCV. Note the modified tail with a dielectric insert at the top and a repositioned flush antenna for the SHORAN. ▼





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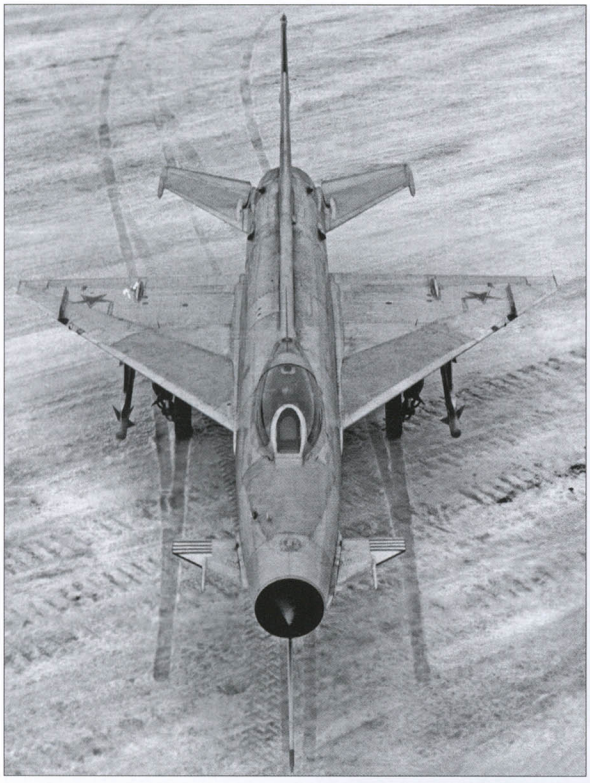
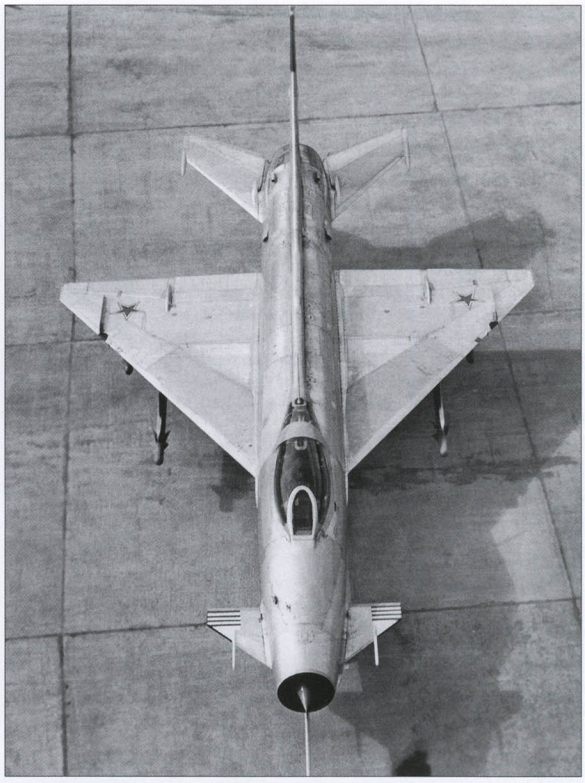
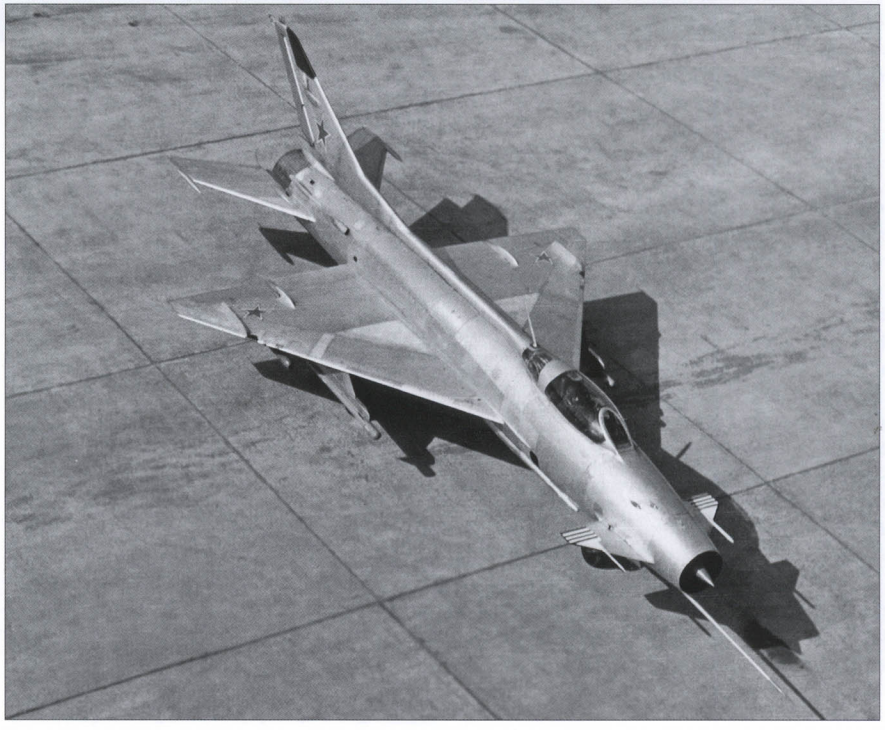
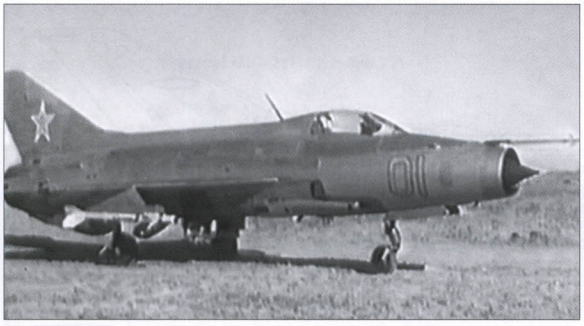
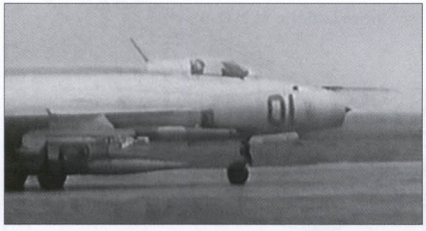




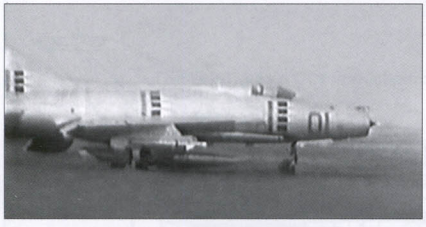
▲ ►
These views of the modified Ye-6T/3 show the cropped-delta shape of the canards, their anti-flutter booms and the photo calibration markings near the trailing edges.

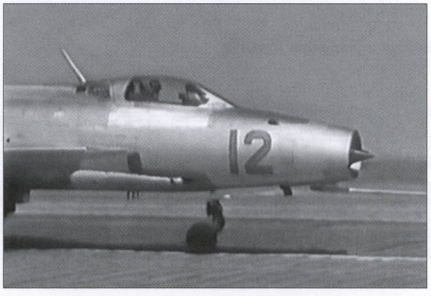




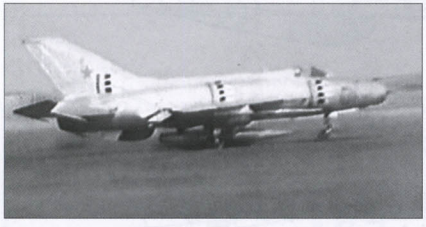


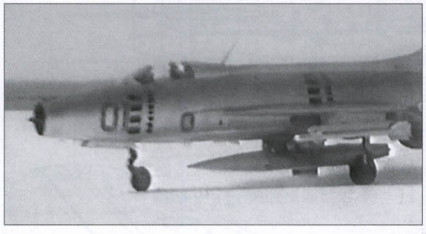
◄◄ ▲
This MiG-21F-13 coded '01 Red' was modified for experimental operations from unpaved airstrips. Note the all-metal fairing aft of the cockpit (in a manner similar to the Czechoslovak S-106) and the dorsally mounted pitot boom.





◄◄
MiG-21F-13 '01 Red' in later guise with photo calibration markings on the fuselage and tail.





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'12 Red' was another experimental MiG-21F-13 which was used to investigate the possibility of operations from PSP runways.

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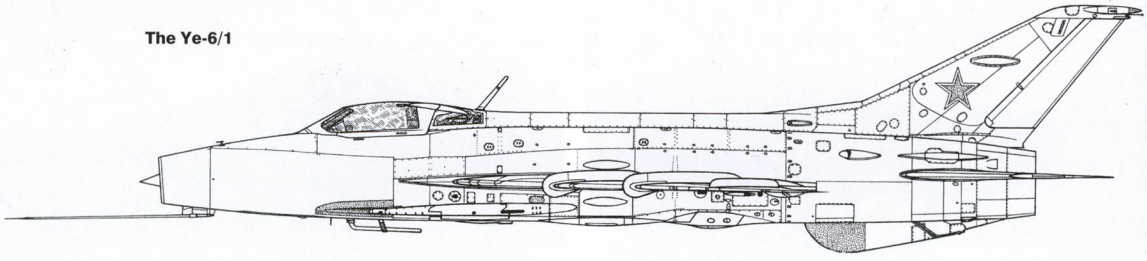
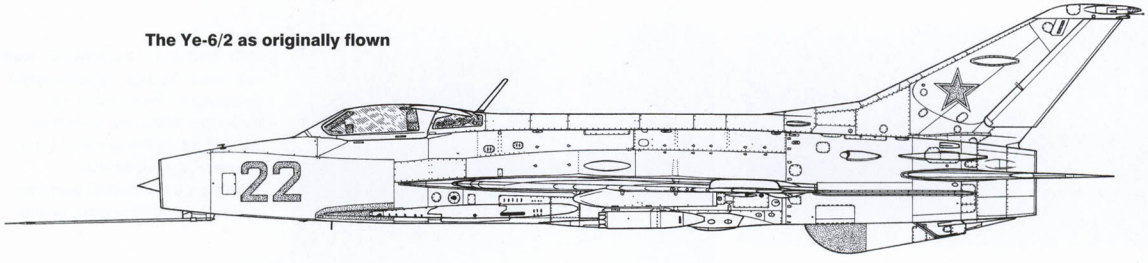
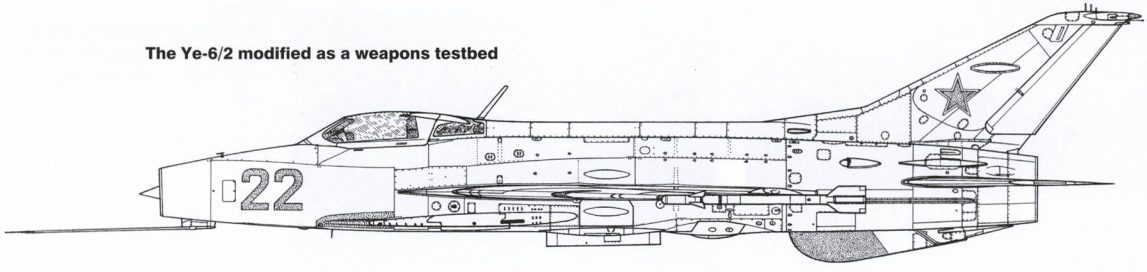
The Ye-6/1



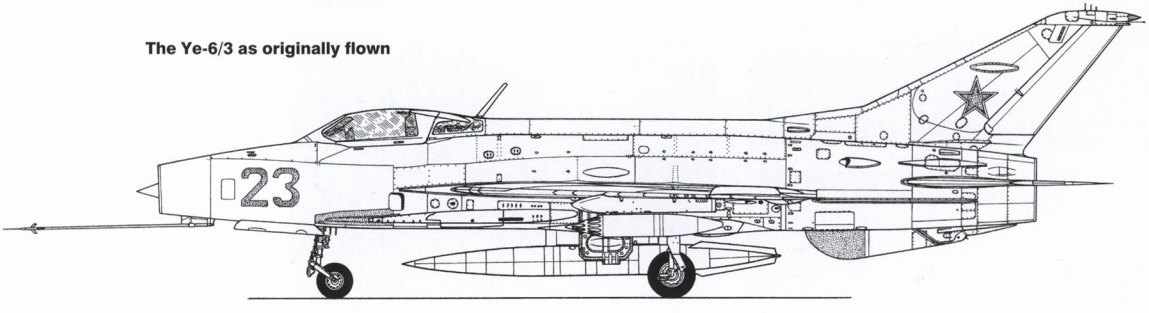
The Ye-6/2 as originally flown



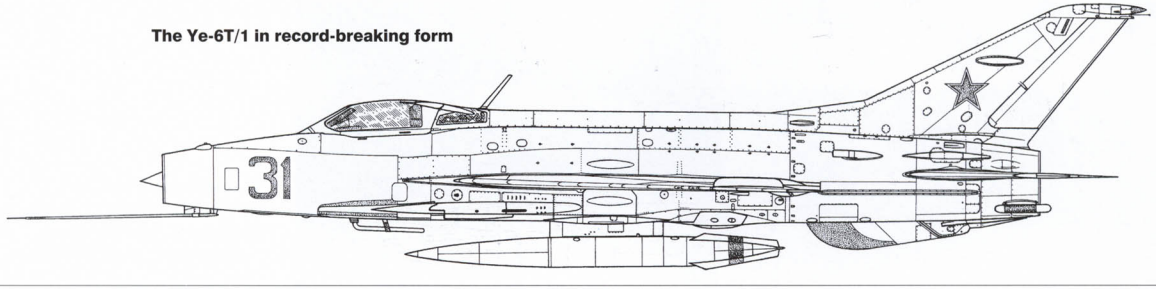
The Ye-6/2 modified as a weapons testbed



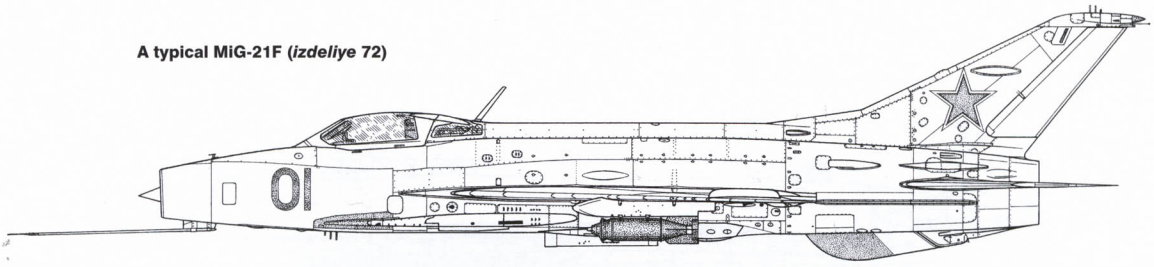
The Ye-6/3 as originally flown



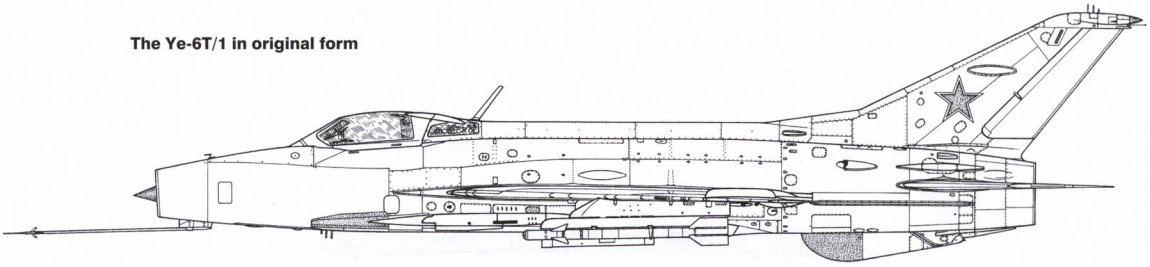
The Ye-6T/1 in record-breaking form



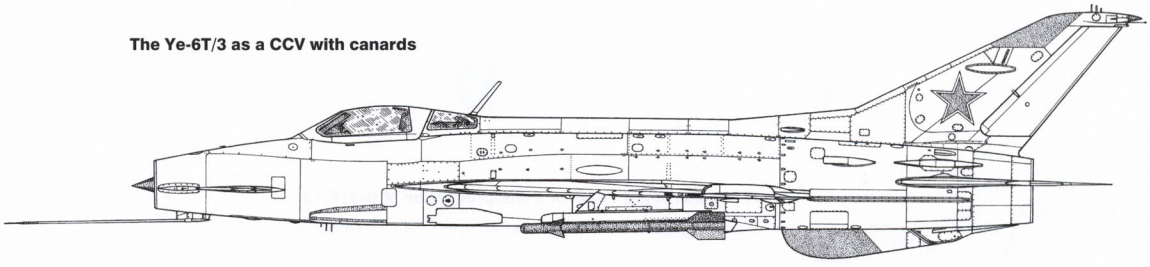
A typical MiG-21F (*izdeliye* 72)



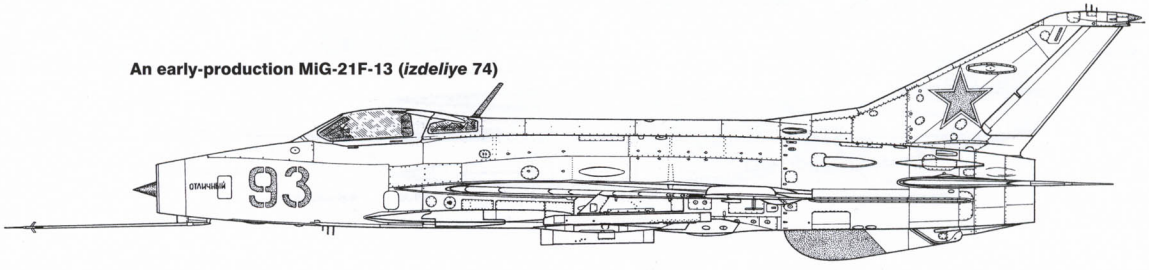
The Ye-6T/1 in original form



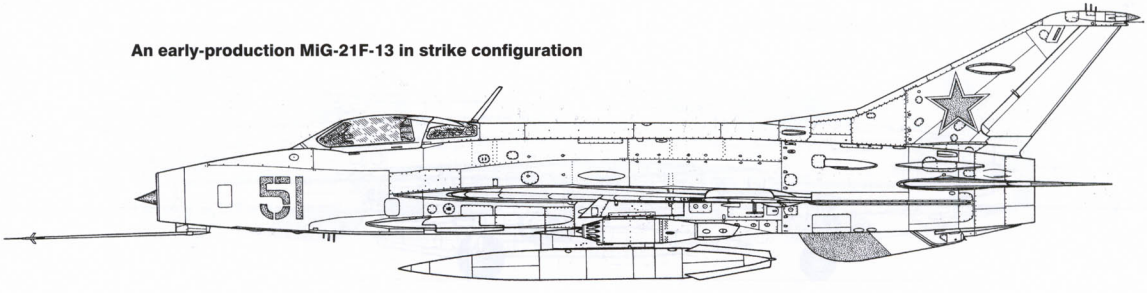
The Ye-6T/3 as a CCV with canards



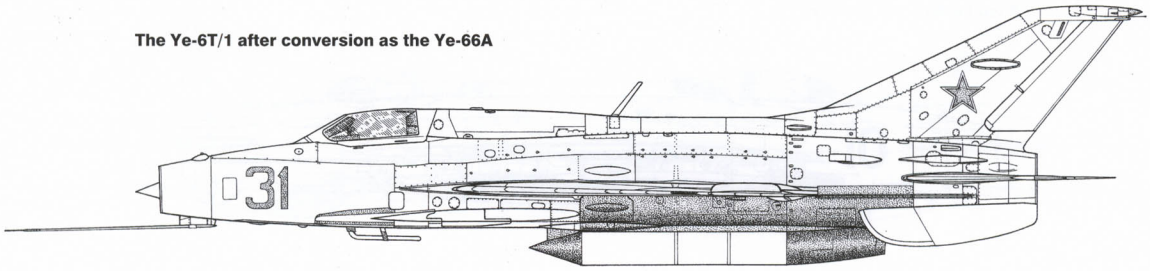
An early-production MiG-21F-13 (*izdeliye* 74)

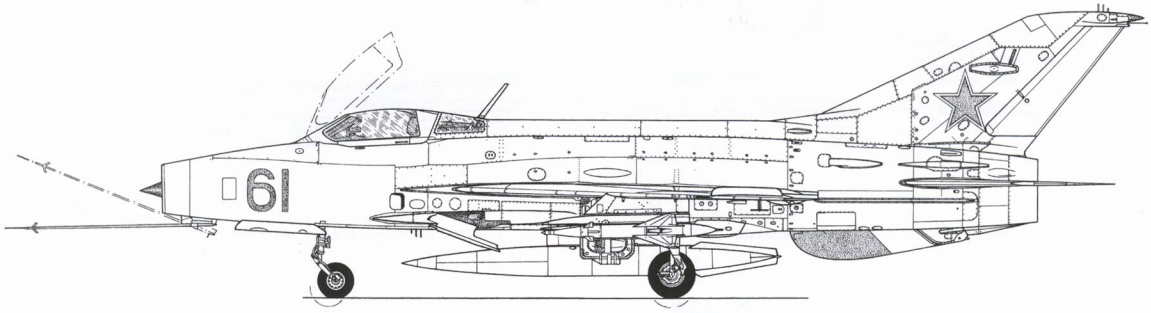


An early-production MiG-21F-13 in strike configuration

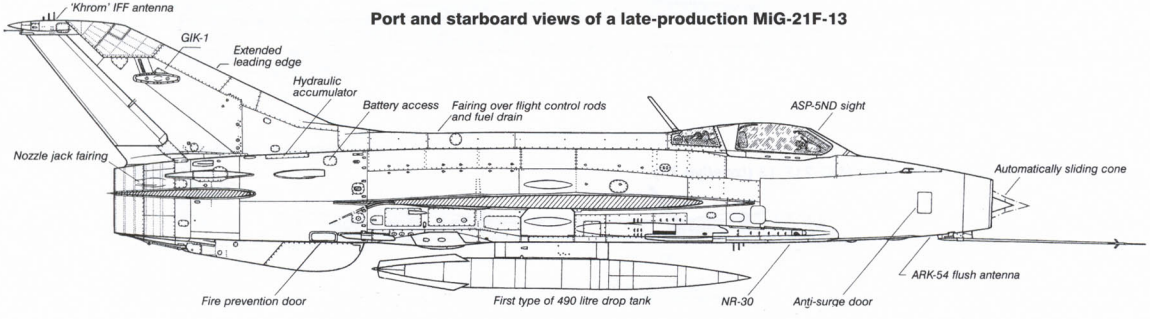


The Ye-6T/1 after conversion as the Ye-66A

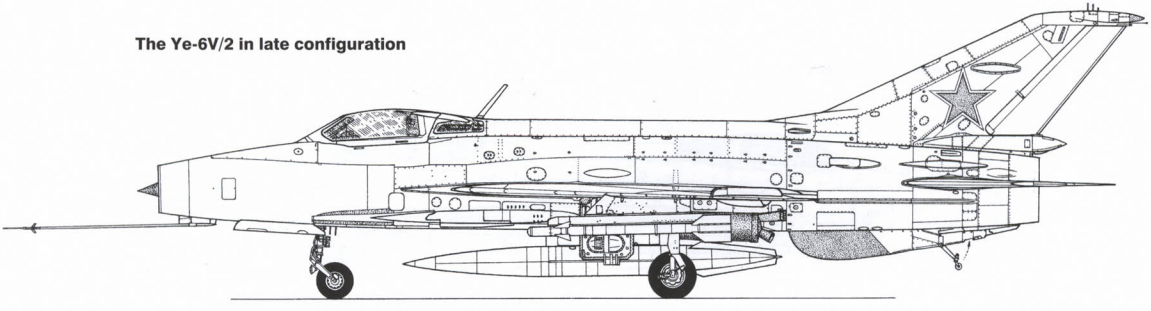




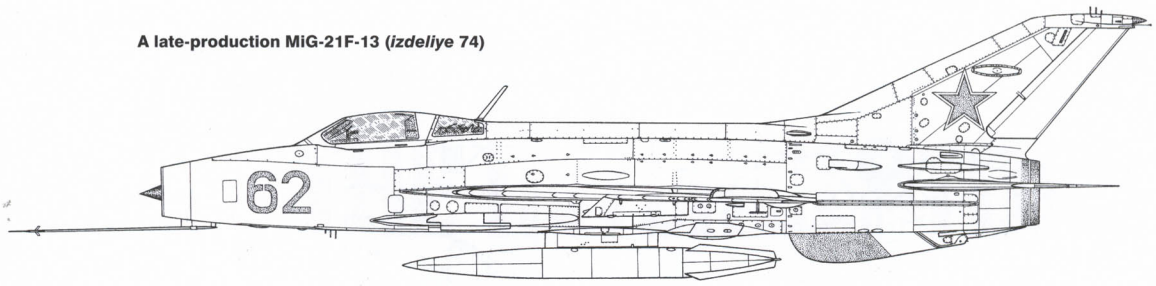
Port and starboard views of a late-production MiG-21F-13



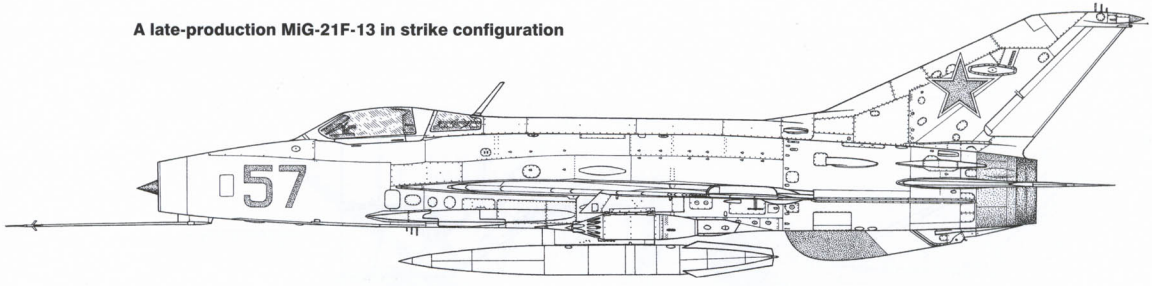
The Ye-6V/2 in late configuration



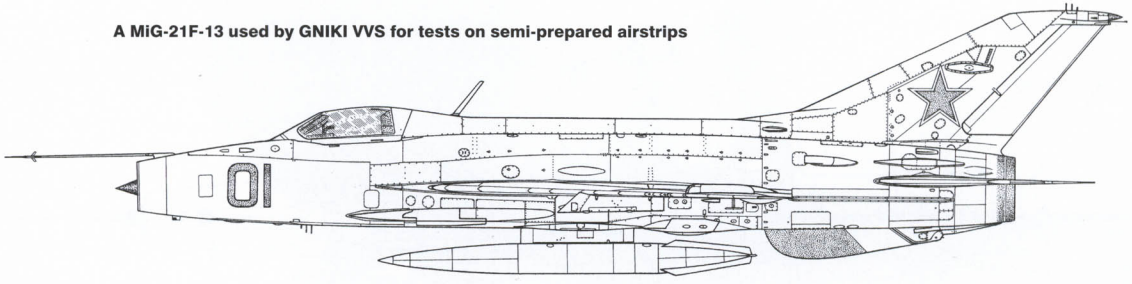
A late-production MiG-21F-13 (*izdeliye* 74)



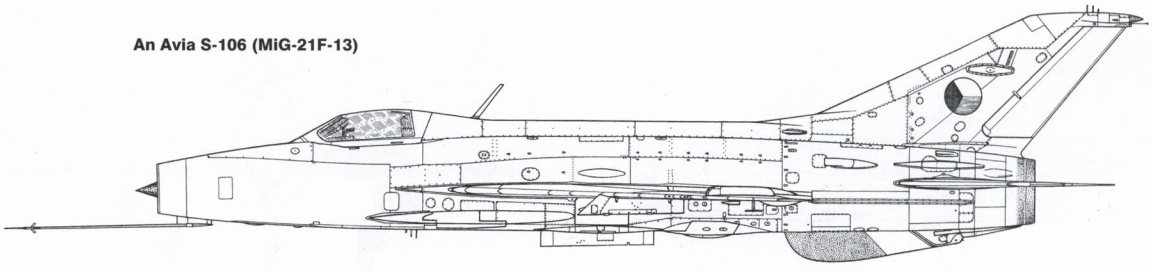
A late-production MiG-21F-13 in strike configuration

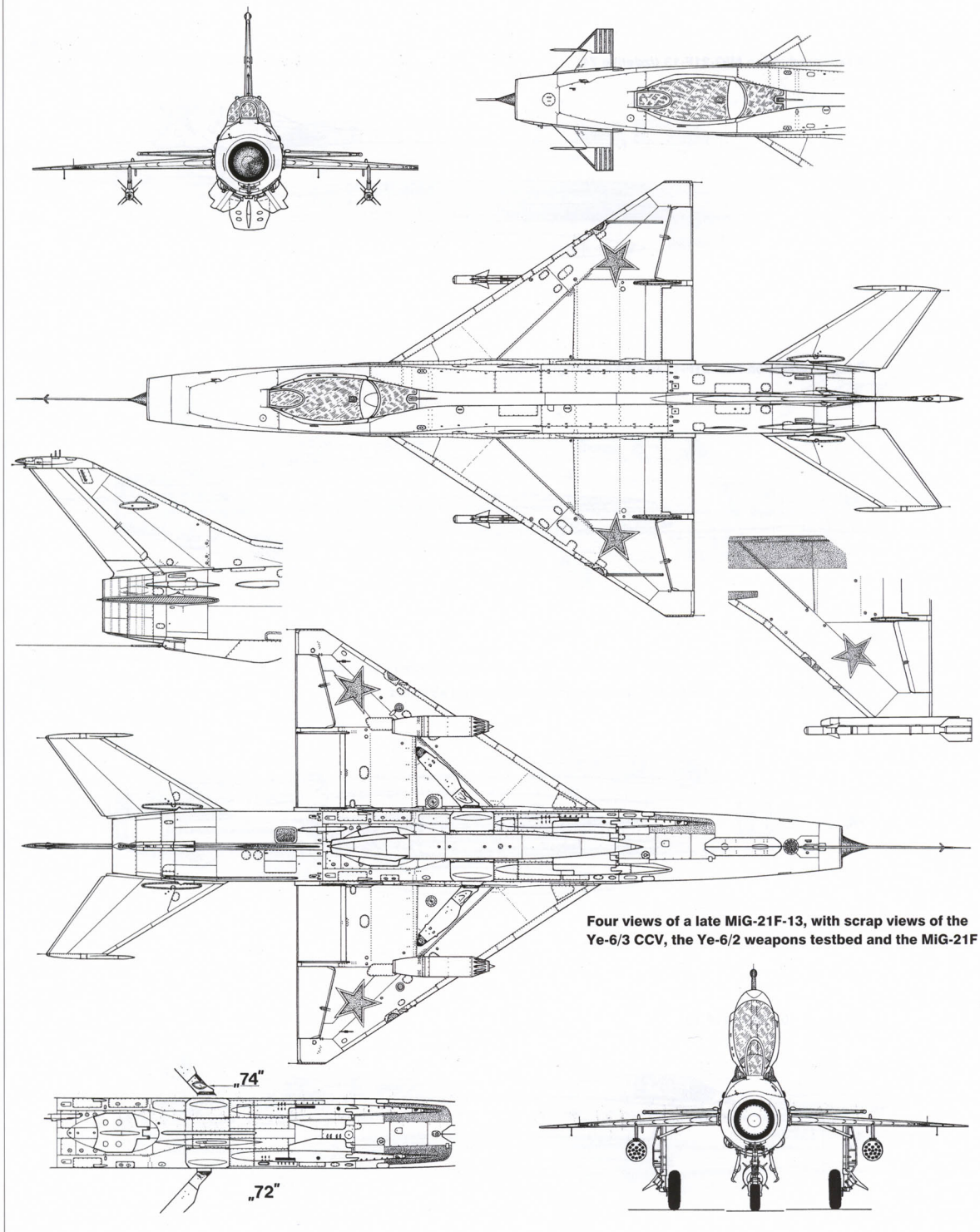


A MiG-21F-13 used by GNIKI VVS for tests on semi-prepared airstrips



An Avia S-106 (MiG-21F-13)





Four views of a late MiG-21F-13, with scrap views of the Ye-6/3 CCV, the Ye-6/2 weapons testbed and the MiG-21F

PART THREE

THE INTERCEPTORS

'71 Red', the first prototype MiG-21P (Ye-7/1) combining the new large intake with the old canopy, fuselage spine and vertical tail. Note the dielectric fin cap and the low-set SHORAN antenna, as on the Ye-6T/3 CCV. The air intake centrebody was all-metal on the Ye-7/1, no radar being fitted.
▼

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Ye-7/1 and Ye-7/2 (MiG-21P) interceptor prototypes

The production cannon-armed MiG-21F and its missile-armed version, the MiG-21F-13, were severely handicapped by their lack of all-weather/night capability; they were effectively limited to operations in visual meteorological conditions (VMC). The MiG-21F-13's ability to use its K-13 (R-3S) AAMs was limited by the modest capabilities of the SRD-5M ranging radar linked to an ASP-5ND computing sight, permitting only attacks of targets within the pilot's eyesight. A version capable of operating in instrument meteorological conditions (IMC) was required.

Therefore on 24th July 1958, long before the Ye-6T entered production, the Soviet Council of Ministers issued directive No. 831-398, which was seconded by GKAT order No. 304 on 2nd August. These documents, which tasked OKB-155 with developing, building and testing the MiG-21F (Ye-6) tactical fighter, contained a clause ordering the OKB to test two modified MiG-21s in 1959. These aircraft were to be armed with two air-to-air missiles and equipped with a fire control radar – the TsD-30 model having a detection range of 18-20 km (11-12.4 miles) against a medium bomber, such as the Tupolev Tu-16. The TsD-30 radar was already fitted to the production Sukhoi Su-9 interceptor, on which it was known as the RP-9 (***rah****dio-****pri****tsel* [*dlya samo****lyo****ta Su-*] ***de****vyat'* – 'radio sight for the Su-9 aircraft'; 'radio sight' was the Soviet term for fire control radars at the time).

By early 1959 the Mikoyan OKB had almost completed the advance development project of the new all-weather interceptor which received the provisional service designation MiG-21P (*pere****khvat****chik* – interceptor) and the manufacturer's designation Ye-7. The bulky TsD-30T radar necessitated a redesign of the forward fuselage: the extreme nose was lengthened and the air intake diameter was increased appreciably – from 0.69 m (2 ft 3⅝ in) to 0.87 m (2 ft 10¼ in). The main pitot boom was still located ventrally on the centreline. The three-position ogival air intake centrebody gave place to a much larger centrebody of simple conical shape accommodating the radar set; its maximum diameter was 0.8 m (2 ft 7½ in) and its position was adjusted smoothly by a synchro system, depending on the flight mode and engine speed. The higher take-off weight forced the designers to eliminate the cannons altogether; yet the PKI-1 collimator sight (*pri****tsel*** *kolli****mah****tornyy istre****bite****l'nyy* – fighter-type collimator sight) replacing the forerunner's ASP-5N gunsight still permitted the Ye-7 to deliver air-to-ground strikes with bombs, unguided rockets and napalm tanks. The PKI-1 also allowed the pilot to attack an aerial target within eyesight with unguided rockets if the radar went unserviceable.

The aerial intercept weapons system based on the Ye-7 was designated MiG-21P-13, the '-13' referring to the K-13 missiles. The interceptor was to be guided towards the target by means of the ***Voz****dookh-1* (Air-1) ground-controlled intercept (GCI) system; hence the Ye-7's avionics suite included *La****zoor'*** (Prussian Blue) command link equipment. The interceptor also featured a KSI compass system developed specifically for fighters (*koorso****va****ya sis****tema*** *istre****bite****l'naya*), an RSIU-5V VHF radio, an updated ARK-54I ADF, an MRP-56P marker

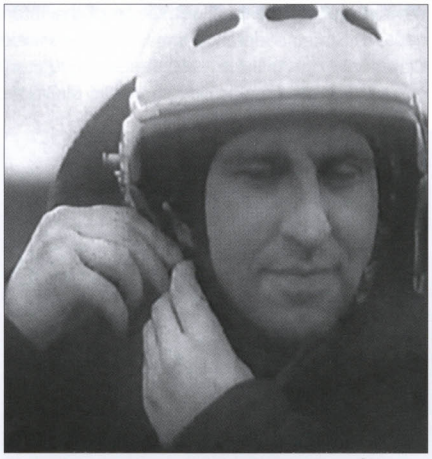
beacon receiver, an RV-U low-range radio altimeter, an SRO-2M IFF transponder and an SOD-57M decimetre-waveband ATC transponder. For high-altitude operations the pilot was provided with a KKO-3 oxygen system and a VKK-4 pressure suit with a GSh-4M pressure helmet. The first prototype Ye-7 was to feature the same ejection seat actuated by a pull-down face blind as used on the MiG-21F, but the designers intended to introduce a more sophisticated seat on production aircraft.

As recounted in the preceding chapter, in the late 1950s the Soviet Air Force gave some serious thought to operating tactical fighters from semi-prepared airstrips. Hence the designers fitted the Ye-7's main gear units with larger KT-50/2 wheels measuring 800 x 200 mm (31.49 x 7.87 in) as opposed to the MiG-21F's 600 x 200 mm (23.62 x 7.87 in) KT-82 mainwheels. This required the mainwheel wells proper and the bulges on the centre fuselage sides above them to be enlarged.

Wearing the appropriate tactical code '71 Red', the first prototype Ye-7 (known in-house as the Ye-7/1) was cleared for manufacturer's flight tests on 10th August 1959. This aircraft had a MiG-21F-type narrow vertical tail and an all-metal intake centrebody, the radar being replaced by test equipment. Konstantin K. Kokkinaki was appointed project test pilot for this aircraft, with V. A. Mikoyan as engineer in charge of the tests; Igor' N. Kravtsov, another OKB-155 test pilot, also participated in the tests.

Unfortunately the Ye-7/1 did not last long; on 26th November 1959 it crashed on its 26th flight with Kravtsov at the controls, the test mission being to establish the fighter's never-exceed speed (V_{NE}). As it approached its speed limit, the fighter started rolling and yawing erratically, subjecting the pilot to large G loads alternating between positive and negative. When the Ye-7/1 entered an inverted spin, Kravtsov realised he could not regain control and ejected safely; the aircraft was totally destroyed, of course. The 'tin kickers' established that the accident was due to loss of directional stability occasioned by a supersonic stall at V_{NE}.

The second prototype designated Ye-7/2 and coded '72 Red' was completed in December 1959. Learning their lesson from the loss of the first prototype, the designers incorporated a number of changes aimed at enhancing directional stability at high Mach numbers into this aircraft. The fin area was increased by 0.18 m^2 (1.94 sq ft) by extending the leading edge and the area of the ventral fin was increased by 0.1 m^2 (1.08 sq ft); additionally, the aircraft was fitted



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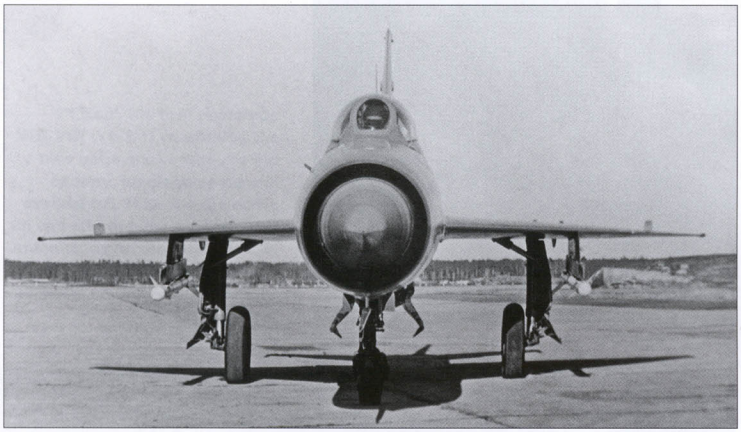
◄ **Mikoyan OKB test pilot Igor' N. Kravtsov who flew the Ye-7/1 and Ye-7/2 – and crashed with both of them.**

with new, thinner BD3-60-21U pylons featuring a smaller area in side elevation. The Ye-7/2 introduced the KAP-1 single-channel autopilot serving only the roll control channel (hence the KAP for ***kren****ovyy* ***av****topi****lot*** – bank [control] autopilot) and stabilising the aircraft in the roll. Finally, the aircraft featured a new SK crew rescue system permitting safe ejection at speeds up to 1,100 km/h (683 mph) and altitudes down to 110 m (360 ft); as in the case of the MiG-21F, the canopy departed together with the seat during ejection, serving as an additional slipstream protection for the pilot.

After passing flutter resistance tests on the ground the Ye-7/2 was trucked to the Mikoyan OKB's flight test facility in Zhukovskiy, making its first flight on 18th February 1960 with project test pilot Pyotr M. Ostapenko at the controls. Again, Igor' N. Kravtsov took part in the flight tests – and fared no better with this aircraft. On 4th July 1960 the Ye-7/2's engine 'stuck' at full military power during the fighter's 72nd flight, refusing to react to throttle movements. The pilot did his best to save the aircraft, attempting a dead-stick landing after the engine quit due to fuel starvation; unfortunately he ran out of altitude about 200 m (660 ft) short of the runway and the fighter overturned after touching down on rough ground. The Ye-7/2 was totalled but the pilot walked away.

Nevertheless, the manufacturer's flight tests of the new interceptor were declared completed even before the loss of the second prototype, namely on 8th May 1960. Just over three weeks later, on 30th May, the CofM Presidium's Commission on defence industry matters (VPK – *Vo****yen****no-pro****mysh****lennaya ko****mis****siya*) passed a ruling ordering the Ye-7 (MiG-21P) into production at the Gor'kiy aircraft factory No. 21

'72 Red', the Ye-7/2, had the radar, enabling the carriage of missiles as seen here, but lacked the dielectric fin cap. ▼



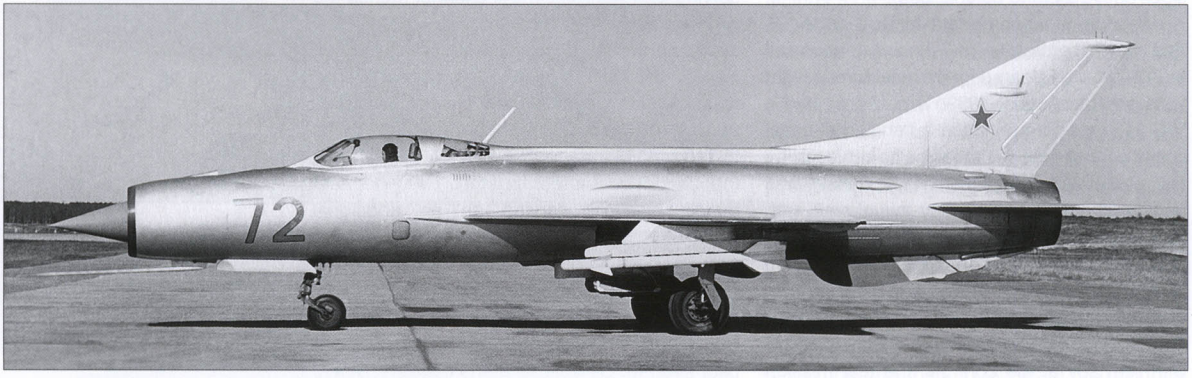
RSK MiG

without waiting for the completion of the interceptor's State acceptance trials. No sooner said than done: on 4th June 1960 the Gor'kiy factory officially started gearing up to build the MiG-21P.

Ye-7/3 and Ye-7/4 interceptor prototypes

In keeping with the GKAT Chairman's instructions, in December 1959 the Mikoyan OKB's prototype construction facility started manufacturing the third and fourth MiG-21P prototypes. The official GKAT order No. 22 to this effect was issued on 15th January 1960.

Coded '73 Red', the third prototype (Ye-7/3) was completed on 4th May 1960 and transported to the flight test facility in Zhukovskiy that same day. This machine introduced a castoring nose gear unit lacking the predecessors' steering mechanism (steering was performed by differential braking). The PTsR-1Sh fuel transfer pumps in the wing tanks were also eliminated, the fuel being transferred to the No. 2 fuselage tank by pressurising the wing tanks. The fighter had a revised TsD-30T fire control radar providing inputs to the K-13 AAMs so that missile launch was only possible within the authorised 'kill' range.



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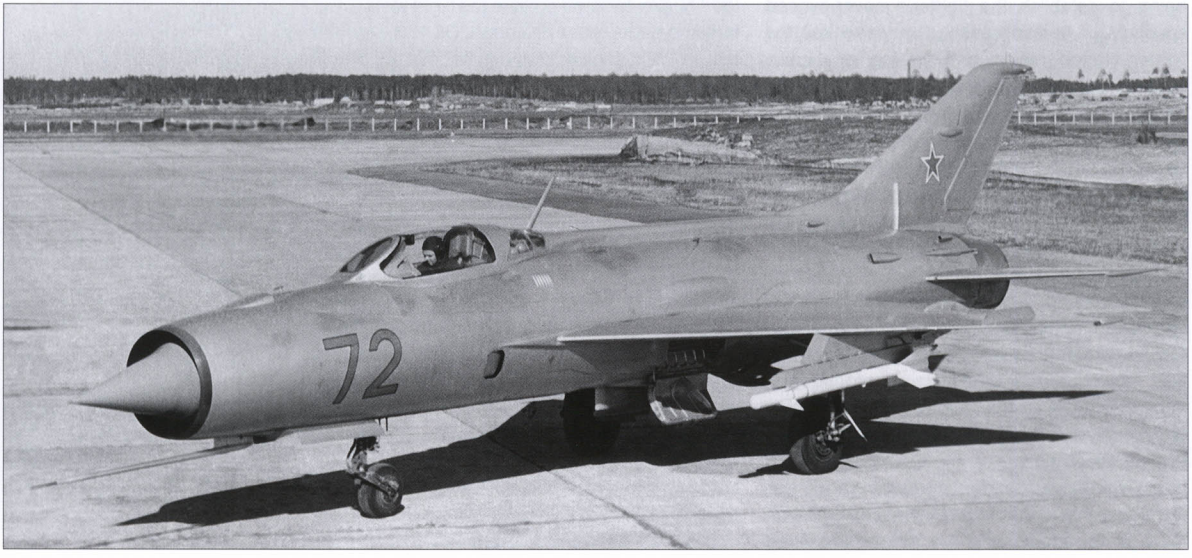

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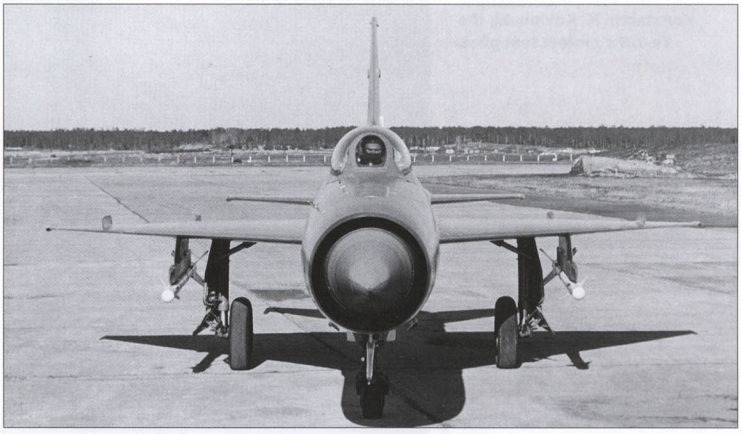
The Ye-7/3's avionics suite included the Lazoor' GCI command link system, the KSI compass system, the KAP-1 autopilot, the RSIU-5 VHF radio, the ARK-54 ADF and the MRP-56P marker beacon receiver. The third prototype was powered by an improved R11F2-300 engine (*izdeliye* 37F2) with two afterburner modes and a maximum afterburner rating of 6,120 kgp (13,490 lbst).

The aircraft's normal take-off weight with two missiles and maximum internal fuel but no drop tank was 7,400 kg (16,310 lb). The Ye-7/3's internal fuel capacity was 2,380 litres (523.5 Imp gal), which equated to a fuel load of 2,000 kg (4,410 lb). Like the Ye-7/2, the interceptor had an SK ejection seat and was initially almost identical in appearance to the second prototype.

Konstantin K. Kokkinaki was appointed project test pilot, with A. I. V'yushkov as engineer in charge. Until 10th May the Ye-7/3 underwent a ground test cycle, including engine runs, refuelling and defuelling to check the fuel system for leaks, and CG position checks. On 11th May the aircraft made its first flight, reaching a maximum speed of Mach 1.5 on that occasion;

More views of the Ye-7/2, showing the larger ventral fin. Note that the pilot is wearing a leather helmet, not a 'bone dome'. ▼



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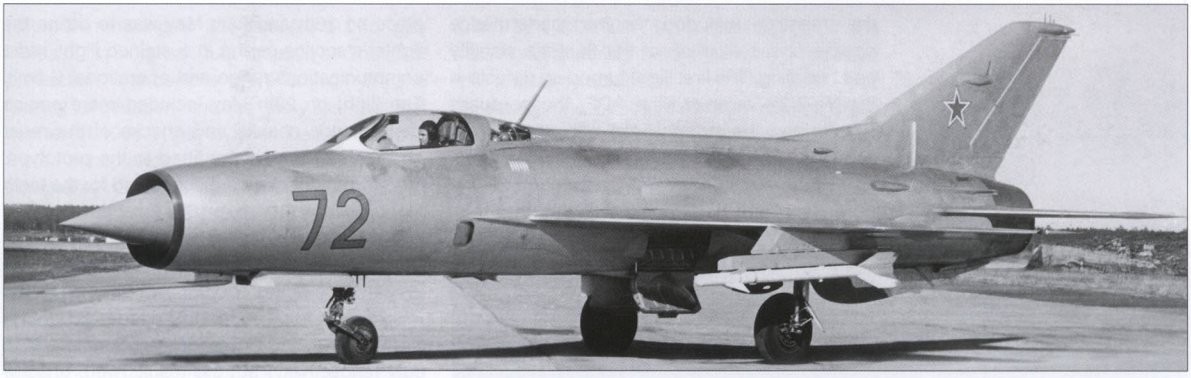

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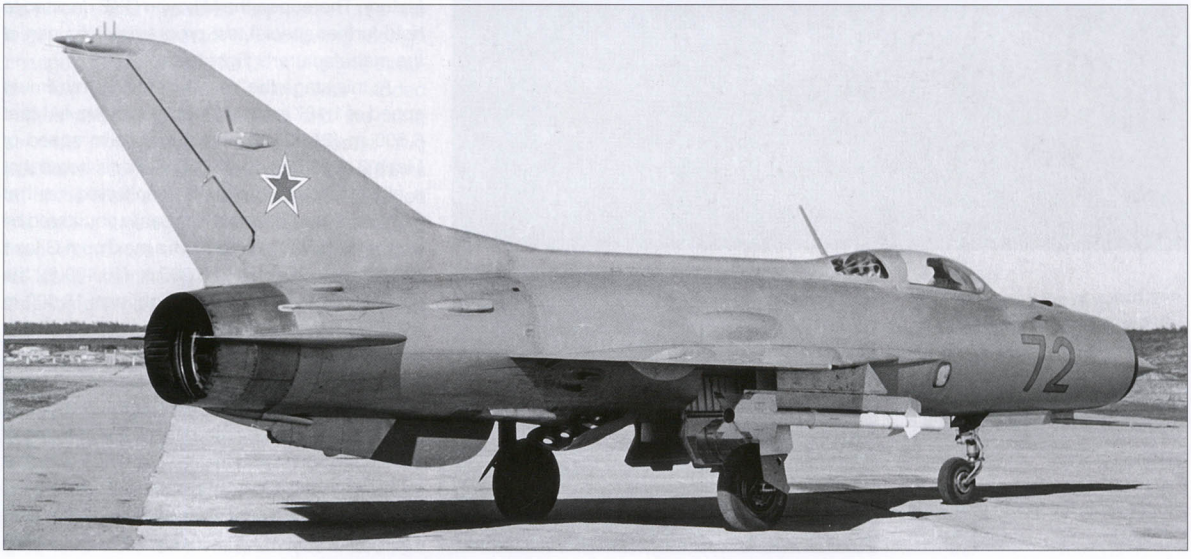

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▶ **Mikoyan OKB test pilot Igor' N. Kravtsov.**

RSK MIG

▶▶ **Mikoyan OKB test pilot Konstantin K. Kokkinaki, the Ye-7/3's project test pilot.**

the mission included engine performance checks and evaluation of the fighter's stability and handling. The first flight turned up defects in the Ye-7/3's avionics (the ADF, the compass system and the radio); these were rectified by 18th May. The following day the machine made its second flight, accelerating to Mach 2. The purpose of the next four test flights that took place on 26th and 27th May was to define the fighter's service ceiling in sustained flight, radio communications range and operational G limit. The flight on 28th May included more engine performance checks and checks of the radar and the test equipment fitted to the prototype. More radar checks were scheduled for the tenth flight which took place on 6th June; however, the PO-3000 AC converter serving the radar set shut down in flight, having overheated during the lengthy pre-flight checks, which meant the mission had to be aborted. The radar did work in the 18th and 23rd flights (on 23rd June and 13th July respectively) but the results were unsatisfactory. Thereupon the Mikoyan OKB decided to hold further special test programmes as part of the manufacturer's flight tests.

At this stage the Ye-7/3 clocked a maximum speed of 1,187 km/h (737 mph) with two AAMs at 6,500 m (21,325 ft) and a maximum speed of Mach 2 at 13,000 m (42,650 ft). Pilots noted that a slight tendency to bank manifested itself at high Mach numbers but was easily countered by opposite stick movement. The maximum G load of 6.23 was obtained at 5,000 m (16,400 ft); the service ceiling in sustained flight was 18,000 m (59,055 ft) at Mach 1.85.

The test report said that *'…MiG-21P No. 73 is virtually identical in piloting techniques and handling to previous examples of the type'*.

However, the abovementioned VPK ruling of 30th May 1960 stated that it was not the MiG-21P in its present form but rather its improved derivative, the MiG-21PF (see below), that was to enter production in Gor'kiy; the MiG-21PF

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▲ **'73 Red', the Ye-7/3, in its ultimate configuration with a bulged fuselage spine incorporating a fuel tank and a larger vertical tail. Note the open forward airbrakes having a revised shape.**

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▶ **'74 Red', the fourth prototype (Ye-7/4).**

RSK MiG

via Internet

◄
LII test pilot Oleg V. Goodkov.

◄◄
Mikoyan OKB test pilot Pyotr M. Ostapenko.

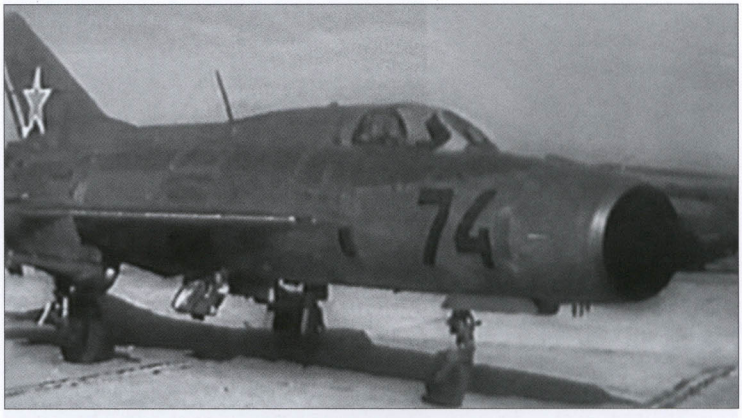
differed in having a 380-litre (83.6 Imp gal) increase in internal fuel capacity. The first production interceptors were to roll off the Gor'kiy production line as early as the first quarter of 1961 – that is, even before the joint State acceptance trials would have been completed. On 11th June 1960 GKAT issued order No. 224 requiring OKB-155 to incorporate and test the additional fuel tankage on the as-yet incomplete fourth interceptor prototype, the Ye-7/4, which was then in the final assembly shop.

Like the third prototype, the Ye-7/4 (in some Mikoyan OKB documents this aircraft is called Ye-7/103) was powered by an R11F2-300 engine. It incorporated the following design changes. Firstly, a 170-litre (37.4 Imp gal) strap-on fuel tank (saddle tank) was added immediately aft of the cockpit and the wing structure was revised to incorporate two additional 105-litre (23.1 Imp gal) integral tanks aft of the main spar. The saddle tank changed the upper fuselage contour appreciably, the fixed rear transparency being eliminated and the fat spine continuing aft for a while before tapering off sharply amidships. The radio aerial was relocated to a position amidships.

Secondly, vertical tail area was increased again by extending the fin leading edge further forward. This was meant to provide adequate directional stability in spite of the higher all-up weight.

Thirdly, the roll control channel featured a new KAP-2 autopilot. Fourth, the main landing gear units were fitted with new 800 x 200 mm (31.49 x 7.87 in) KT-92 mainwheels and the nosewheel steering mechanism was replaced with a shimmy damper.

Finally, the structure of the extreme nose was modified to accommodate the intended TsD-30TP radar. This new version of the radar exhibited higher resistance to enemy electronic



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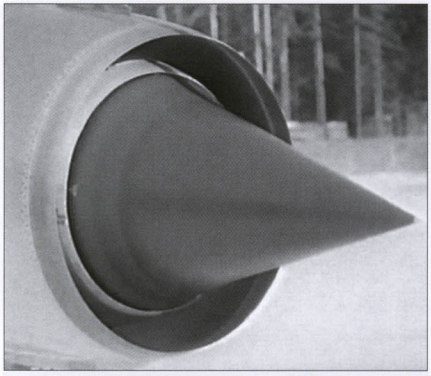
◄▲
The Ye-7/4 was the first MiG-21P (Ye-7) to have the fat spine and the large vertical tail from the start. The tactical code is darker than the star insignia on the tail and appears to be blue, but was actually a different shade of red.



▶
The Ye-7/4's air intake centrebody in the aft (low-speed) and fully forward (high-speed) positions.
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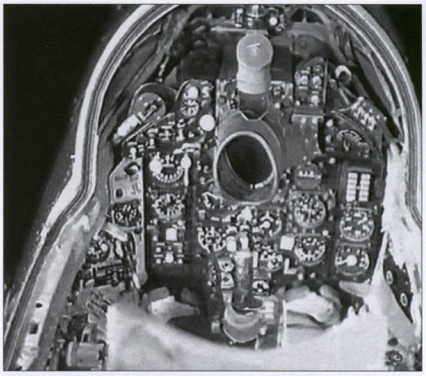

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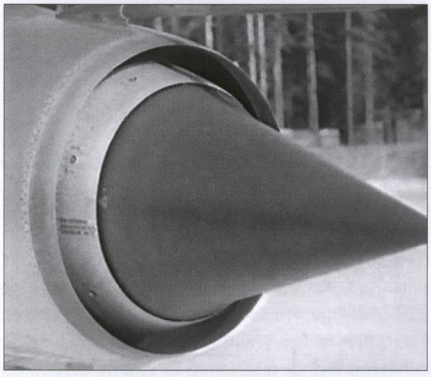
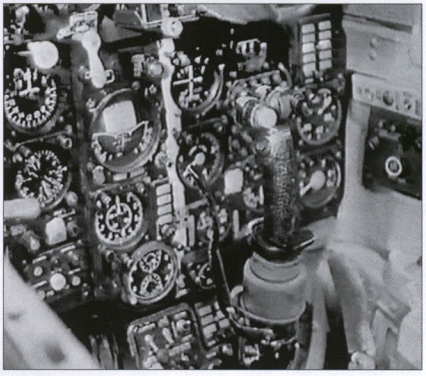
The Ye-7/4's cockpit with the radarscope (complete with rubber sunblind) above the instrument panel.





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The Ye-7/4's instrument panel and starboard cockpit console.
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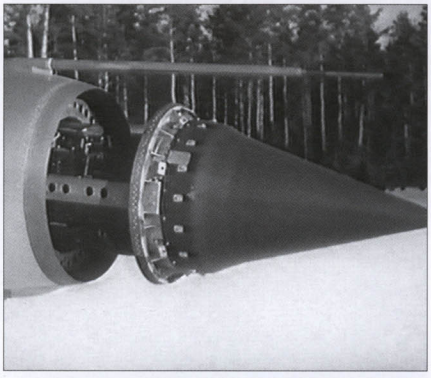

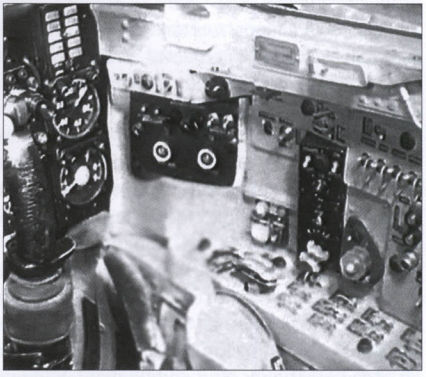

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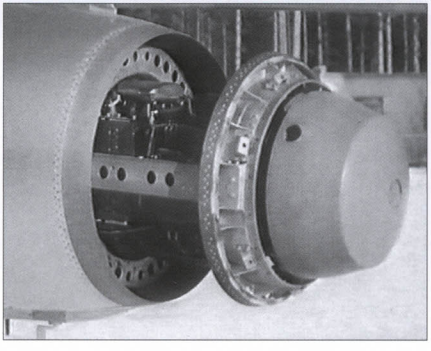
The TsD-30TP radar slid forward on its bearer out of the air intake for maintenance.



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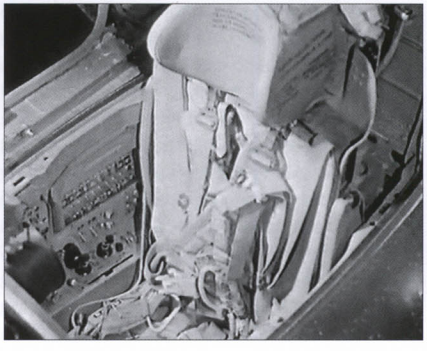
The TsD-30TP with the radome removed, exposing the radar antenna.



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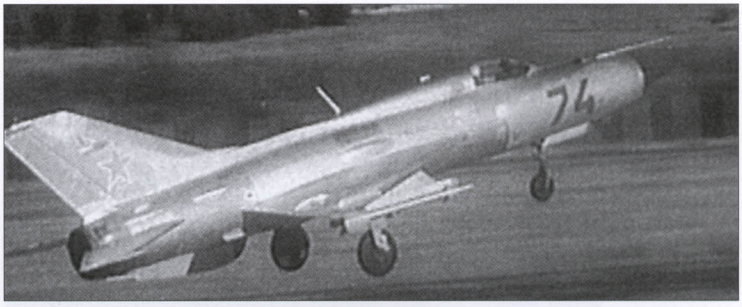
The SK ejection seat.

All photos Yefim Gordon archive



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The rear fuselage and tail unit of the Ye-7/4.

◄ ▲
The Ye-7/4 in flight with two orange-painted dummy K-13 AAMs.

Oleg V. Goodkov poses with one of the Ye-7 prototypes. Note the open forward avionics bay cover.
▼

All photos Yefim Gordon archive

countermeasures (ECM), hence the P suffix standing for *po**mekh**ozashchi**shchon**nost'* – ECM resistance.

The Ye-7/4 (coded '74 Red') entered manufacturer's flight test on 8th August 1960. Upon completion of the tests the aircraft was transferred to GK NII VVS for State acceptance trials. By then the Ye-7/3 had been converted to the same standard and likewise handed over to the military, joining the fourth prototype in the State acceptance trials programme. The latter was completed on 30th June 1961, the State commission giving a positive appraisal to the interceptor. The TsD-30T had a 20-km (12.4-mile) detection range and could track targets at up to 10 km (6.2 miles) range.

In the course of the manufacturer's flight tests and State acceptance trials the Ye-7/3 and Ye-7/4 made a total of 160 and 154 flights respectively. The modified interceptors attained a top speed of 2,175 km/h (1,351 mph), a service ceiling of 19,000 m (62,335 ft) and a range of 1,600-1,700 km (993-1,056 miles); the take-off and landing runs were 850 m (2,790 ft) and 900 m (2,950 ft) respectively. By the time the State commission recommended the interceptor for production and Soviet Air Force service, MiG-21PF production at the Gor'kiy factory No. 21 had actually begun.

Upon completion of the State acceptance trials the third and fourth prototypes were used in various special test programmes. In particular, in 1962 the Ye-7/4 was equipped with a

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▶
Close-up of the Ye-7/4's nose; note the four 'kill' stars denoting successful missile launches.
▶▼

▶▶▶
This sequence shows the Ye-7/4 taxiing and taking off from the grass runway at LII during rough-field suitability tests in 1962.

Opposite page, top: Female pilot Yevgeniya N. Martova poses with the specially lightened Ye-7/3 in which she set a world speed record on 18th February 1967. The aircraft was known to the FAI as the Ye-76.

Opposite page, centre and bottom: Seen here taking off at Moscow-Domodedovo airport during the 9th July 1967 airshow, the Ye-7/4 is depicted in its ultimate guise matching the production MiG-21PF. Note the high-set pitot boom and the AoA sensor fairing on the port side of the nose.

All photos Yefim Gordon archive

The modified Ye-7/4 taxies out for take-off at Domodedovo.
▼

Boris Vdovenko

wheel/skid landing gear in order to explore the possibility of operating the fighter from dirt strips with a bearing strength as low as 4 kg/cm² (57 lb/sq in), with the fighter producing wheel ruts up to 5 cm (1 31/32 in) deep. In the course of these tests it transpired that the low-mounted main pitot was promptly clogged by dirt and dust on unpaved airstrips, putting the flight instruments out of action. The remedy was to move the pitot boom from the underside of the nose to the air intake's upper lip; it was still mounted on the centreline for the time being. The Ye-7/3, which did not participate in this programme, was modified in the same way.

More modifications to the Ye-7/4 followed in 1962: the fighter was fitted with a new ventral fin with an area increased to 1.16 m² (12.49 sq ft). In this guise the aircraft underwent renewed manufacturer's flight tests in August 1962 for the purpose of checking how the larger ventral fin affected directional stability; Pyotr M. Ostapenko flew the aircraft, with I. A. Solodoon as engineer in charge. The fighter's handling with two K-13

AAMs was checked at speeds up to Mach 2.1. The programme included three flights; on the first occasion (on 22nd August) the Ye-7/4 reached Mach 2.04 at 15,000 m (49,210 ft). The following day it attained Mach 2.1 at the same altitude, and on 30th August the maximum speed attained at 13,000 m (42,650 ft) was Mach 2.0. The test report said that the modified Ye-7/4 had a better directional stability margin than the production-standard MiG-21PF.

In fact, originally the modified aircraft was fitted with an even bigger ventral fin having an area of 1.3 m^2 (13.99 sq ft). Later, however, the designers decided this was too much and shaved off 120 mm ($4^{23}/_{32}$ in) along the entire length, reducing the area by 0.14 m^2 (1.51 sq ft).

In 1963 the Ye-7/3 became a weapons testbed for the K-13R AAM – the semi-active radar homing version of the K-13 (hence the R for ***rah**diolokatsi**on**naya* [*go**lov**ka **sa**monave**den**iya*] – radar seeker head). In production form the missile was designated R-3R.

In 1966-67 the same aircraft was specially lightened by removing all surplus equipment items (including the weapons control system and missile pylons) for a series of women's world speed records. Marina I. Solov'yova was the first to set a record in the Ye-7/3; on 16th September 1966 she attained an average speed of 2,062 km/h (1,281 mph) over a 500-km (310-mile) closed circuit. A month later Yevgeniya N. Martova averaged 900.267 km/h (559.172 mph) over a 2,000-km (1,242-mile) closed circuit. On 18th February 1967 she set another record, covering a 100-km (62.1-mile) closed circuit with an average speed of 2,128.7 km/h (1,322.1 mph). Interestingly, in the official Soviet documents submitted to the FAI the record-breaking aircraft was referred to as the Ye-76 (in effect, the product code of the production MiG-21PF was used as the designation).

The Ye-7/4 was among the fighters appearing in the flying display at the Moscow-Domodedovo airshow on 9th July 1967.

MiG-21PF production interceptor (*izdeliye 76*; *Fishbed-D*)

In its production 'fat back/big tail' form the Ye-7 was known at the Gor'kiy aircraft factory as *izdeliye* 76. The first uncoded production MiG-21PF (c/n N76210101) powered by an R11F2-300 engine took to the air at Gor'kiy-Sormovo (the factory airfield) on 28th June 1961 with factory test pilot S. I. Savchenkov at the controls. After the maiden flight the fighter was ferried to Zhukovskiy for modifications by the Mikoyan OKB; Konstantin K. Kokkinaki

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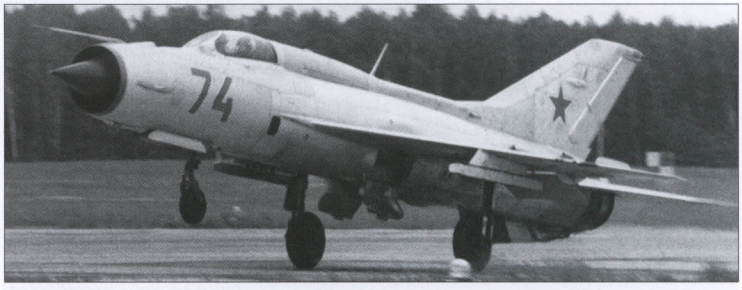
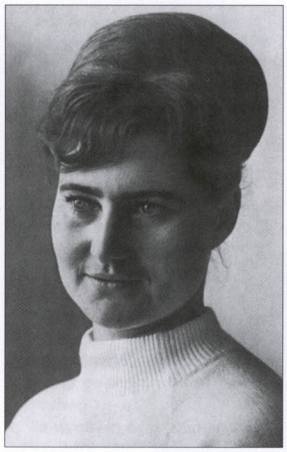


Boris Vdovemko

Boris Vdovemko



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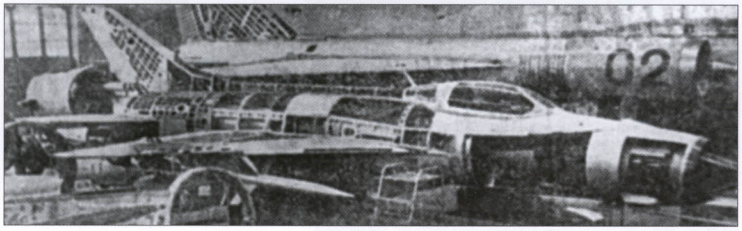
▲ **Pilot Marina I. Solov'yova who set another speed record in the Ye-7/3 (Ye-76) on 16th September 1966.**

performed the first flight from there on 4th July. Later that month the first production MiG-21PF participated in the traditional Aviation Day flypast at Moscow-Tushino together with the other latest Soviet prototypes and production aircraft. The interceptor received a special colour scheme for the occasion – the underside of the wings ahead of the quarter-chord line was painted bright red, the red stripes wrapping around the underside of the fuselage and merging on the centreline to form a sort of arrowhead.

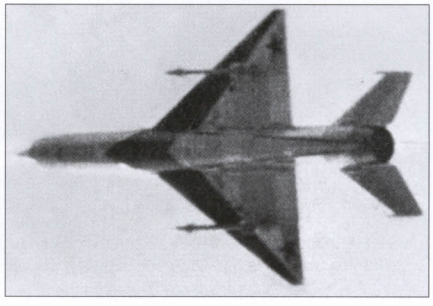
The production-standard MiG-21PF (*izdeliye* 76) differed from the Ye-7/3 and Ye-7/4 in a number of respects. First of all, the TsD-30T fire control radar was replaced by the TsD-30TP radar in keeping with a VPK ruling. In its production form the radar was designated RP-21 (***rah****dioprit****sel*** [*dlya samo****lyo****ta MiG-*] ***dva****dtsat' o****din*** – 'radio sight for the MiG-21 aircraft'); this designation also found its way into Air Force documents. The radar scanner was stabilised in the bank. The TsD-30TP also had a larger radarscope in the cockpit as compared to the TsD-30T fitted to the Ye-7 prototypes.



▲ **This strange-looking aircraft used as a cutaway instructional airframe at the Moscow Aviation Institute has the nose, spine and vertical tail of the Ye-7/1 but features a dorsal brake parachute housing. It is probably a non-flyable teaching aid composed of several airframes.**

Secondly, the avionics/equipment bay aft of the cockpit was slightly widened at the expense of the No. 1 fuselage fuel tank whose capacity was reduced by 80 litres (17.6 Imp gal). Thirdly, the weapons control system was revised, enabling the MiG-21PF to carry the RS-2-US (alias K-5MS) radar-homing (beam-riding) AAMs inherited from the MiG-19PM interceptor; these were carried on APU-7 launch rails.

The IFF system now included an SRZO-2M Khrom-Nikel' (Chromium-Nickel) interrogator/transponder (*samo****lyot****nyy* ***rah****diolokatsi****on****nyy za****pros****chik-ot****vet****chik*). Some structural changes were made, including local reinforcement of the inlet ducts and the wing structure near ribs 2 and 3; the forward fuselage incorporated larger auxiliary inlet doors preventing engine surge. The nose gear unit was redesigned and the main gear doors were revised to avoid coming into contact with the fins of the RS-2-US AAMs. Finally, the pitot boom was located dorsally on the centreline, just like on the modified Ye-7/3 and Ye-7/4.



▶ **The first production MiG-21PF (c/n N76210101) performs in a special colour scheme at Moscow-Tushino in 1961.**

The Mikoyan OKB's prototype construction facility made a total of 61 design changes to the first production MiG-21PF in December 1961 and January 1962. On 12th March 1962 the aircraft was transferred to the flight test facility in Zhukovskiy, making its first post-modification flight on 20th March at the hands of Pyotr M. Ostapenko. Manufacturer's flight tests of MiG-21PF c/n N76210101 continued until 7th May, whereupon the aircraft was transferred to GNIKI VVS for joint State acceptance trials; these were duly completed in July 1962. The State commission recommended the TsD-30TP radar for installation as a standard fit; as a result of the trials the radar's minimum operational altitude was reduced from 4,000 m (13,120 ft) to 2,000 m (6,560 ft).

The first six production batches left the factory with the old TsD-30T radar; it was also known as the RP-9-21 (that is, RP-9 adapted for the MiG-21. Even so, from c/n 76210501 (that is, from Batch 5) onwards the rear avionics/equipment bay was widened to take the bulkier radar set of the forthcoming TsD-30TP (RP-21) radar. The latter became a standard fit from MiG-21PF c/n 76210703 onwards.

Once the State acceptance trials had been completed, the first production MiG-21PF became a testbed for the K-51 weapons system. To this end the aircraft was fitted with small underwing pods housing S-13-100, S-13-300 and PAU-471 ciné cameras to record test launches of RS-2-US missiles. Renewed State acceptance trials of the MiG-21PF equipped with the K-51 weapons system took place between 20th November 1962 and 3rd September 1963 and the system received a thumbs-up. The integration of the RS-2-US expanded the MiG-21PF's operational envelope, enhancing its day/night IMC capability; it also permitted daylight/VMC (line-of-sight) launches of the missiles with the radar operating in 'fixed beam' mode, using the PKI collimator sight.

The first production example to have the K-51 weapons system was MiG-21PF c/n N76211615.

From c/n N76211701 the system was fitted as standard to this version. In addition to AAMs, the MiG-21PF could carry two 16-round UB-16-57U rocket pods loaded with 57-mm (2.24-in) S-5 FFARs or two bombs of 100- or 250-kg (220- or 551-lb) calibre when flying strike missions.

Production MiG-21PFs had the UVD-2M air intake control system that smoothly adjusted the position of the air intake shock cone throughout the flight envelope. At low power the shock cone was in the fully aft position, protruding 1,213 mm (3 ft 11¾ in) beyond the intake lip; in flight it could move forward up to 200 mm (7⅞ in), depending on the engine power setting and flight mode (speed and altitude).

The production MiG-21PF had an internal fuel capacity of 2,750 litres (605 Imp gal). Additionally, a standard 490-litre (107.8 Imp gal) drop tank could be fitted to the centreline pylon.

The first all-weather version was in production at the Gor'kiy plant in 1962-68 (Gor'kiy-built examples were delivered to the 'home market' only); additionally, in 1964-68 MMZ No. 30 'Znamya Truda' produced the MiG-21PF exclusively for export (see next entry). In early 1962 the Soviet Minister of Defence signed an order officially including the MiG-21PF into the Soviet Air Force inventory; the type saw service with the VVS and the PVO alike.

The MiG-21PF's NATO reporting name was *Fishbed-D*.

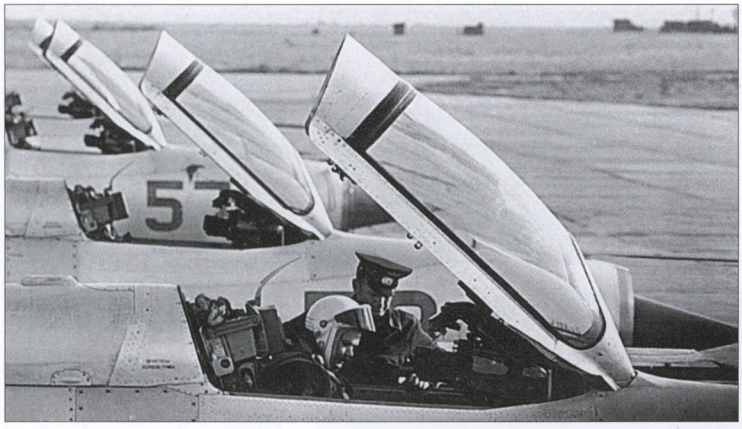
◄▲
MiG-21PF c/n N76210101 with two dummy K-13 AAMs and a PTB-490 drop tank.

Two more views of the specially painted first production MiG-21PF. Note the open forward airbrakes.
◄▼

All photos RSK MiG

MiG-21PF export version (*izdeliye* 76, Version A)

The Moscow-built export version of the MiG-21PF supplied to the Soviet Union's Warsaw Pact (WarPac) allies was referred to in technical manuals as '*izdeliye* 76, Version A' (sic – although '*izdeliye* 76A' would seem to be more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▲
A MiG-21PF pilot receives last-minute instructions before a sortie.

▶
Blue-coded MiG-21PFs operated by one of the units at Kubinka AB.

Production MiG-21PFs seen immediately after touchdown with the airbrakes deployed.
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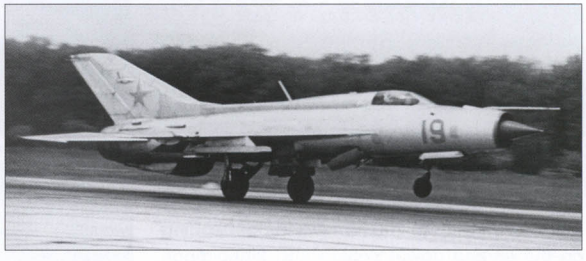
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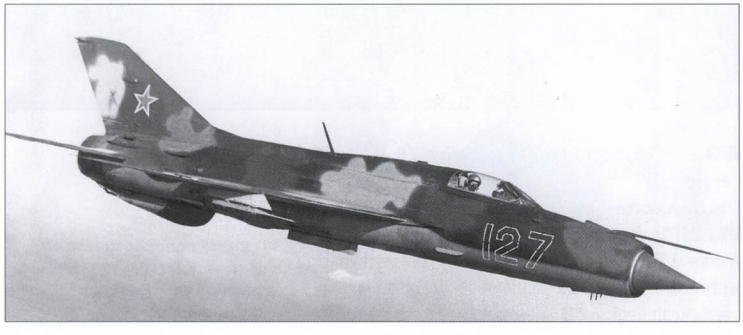
This MiG-21PF wears four-tone camouflage. The three-digit low-visibility code '127 While outline' indicates the aircraft is operated by an Air Force flying college.
▼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Force (EGAF) had their RP-21 radars upgraded in order to enhance their strike capabilities. In order to discern such upgraded aircraft from the standard ones they were given the local designation MiG-21PFM (*modifiziert* – modified). This unofficial designation bore no relation to the true MiG-21PFM built in the USSR (*izdeliye* 94; see below).

MiG-21PFL export interceptor (*izdeliye* 76)

A special version of the MiG-21PF tailored to a Vietnamese order was designated MiG-21PFL (the meaning of the L suffix is unclear). It was identical in armament, avionics and equipment to the MiG-21PF (*izdeliye* 76, Version A), except that the ARK-10 ADF lacked the distance logical). Such interceptors differed from their Soviet Air Force sister ships only in having different IFF equipment.

Interestingly, some MiG-21PFs (*izdeliye* 76, Version A) delivered to the East German Air measuring module, the radio altimeter was deleted and the KSI compass system was replaced by the more refined KSI-2 version. In some publications this aircraft was referred to in error as the MiG-21PF-V (that is, 'Vietnamised') – a designation that never existed.

MiG-21PF wheel/skid landing gear testbed

A single production MiG-21PF coded '02 Red' (c/n N76210820) was modified in 1963 with a view to improving its ability to operate from unpaved tactical airstrips. The aircraft was equipped with a wheel/skid landing gear similar to that tested on the Ye-7/4 prototype in 1962. The skids were fitted to the main units only; they were made of titanium and had a surface area of 600 cm² (93 sq in), reducing the runway loading by 50%. The wheel/skid landing gear allowed the

Sergey Scrynnikov

▲
A flight of MiG-21PFs transferred to a fighter-bomber unit and painted in a three-tone camouflage. Note that the undersides are natural metal, not blue as they should be.

fighter to operate from soggy airstrips with a bearing strength of no more than 4 kg/cm². The skids were lowered into position by hydraulic rams, being almost level with the bottoms of the mainwheels; for operation from normal (firm) runways they were raised clear of the ground. The nose gear unit was unaltered.

Like the modified Ye-7/4, MiG-21PF c/n N76210820 was tested with two dummy R-3S missiles on the wing pylons. Curiously, the pylons proper and the missile launch rails attached to them were borrowed from another MiG-21PF (c/n N76210725, see below). Cine films shot during the tests clearly show that the pylons of MiG-21PF '02 Red' were marked 0725.

Boris A. Orlov was project test pilot for this programme. The following is an extract from his memoirs:

'With the skids lowered into position the aircraft turned into a real all-road vehicle, if not exactly a cross-country vehicle. On occasion a lorry would have trouble moving across the field, whereas my MiG would just whiz through all that mud... Yet we took care to keep out of the worst mud because the nosewheel tended to sink into the soft ground almost up to the axle.

The flights proper presented no major problems – I would take off and land again some time later after burning off the fuel. However, I had to touch down exactly at the specified spot where the bearing strength of the strip had been measured – in other words, on a very limited stretch of runway.'

Even though the results were good, the Mikoyan OKB decided against using the wheel/skid landing gear on the MiG-21. The only Soviet tactical aircraft to utilise this type of landing gear in service was the Su-7BKL fighter-bomber (the KL suffix denoted *ko**lyos**no-**lyzh**noye shas**see*** – wheel/skid landing gear).

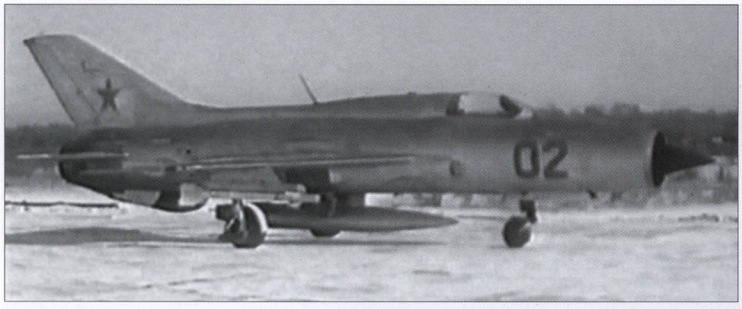
MiG-21PF development aircraft with increased vertical tail area

As the MiG-21PF entered production, OKB-155 kept working on refining the fighter. One particular concern was to improve the MiG-21's

MiG-21PF '02 Red' (c/n N76210820) was fitted experimentally with a wheel/skid landing gear. Note the raised skids outboard of the mainwheels.
▼

RSK MIG

RSK MIG



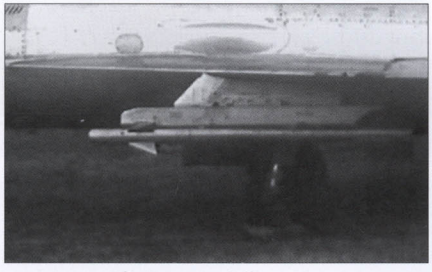
▲
MiG-21PF '02 Red' during tests on a snow-covered airstrip.

▶
The starboard hydraulically powered skid of MiG-21PF '02 Red' in standby position. Note that the wing pylon is borrowed from another MiG-21PF (c/n N76210725).

▶
The starboard skid of MiG-21PF '02 Red' lowered into operating position.

▶▶▲
This series of stills from a ciné film shows '02 Red' taxiing and taking off during soft-field tests.
▶▶▼

MiG-21PF '02 Red' moving on skids.
▶



MiG-21PF '02 Red' deploys its brake parachute after landing on a dirt strip.
▶▼

The ruts left by MiG-21PF '02 Red' after landing on a soggy dirt airstrip.
▼

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directional stability, which still left something to be desired. Several aircraft were modified as part of this effort, including an uncoded MiG-21PF (c/n N76210725). This aircraft featured a new vertical tail that was later to become standard on most versions of the MiG-21 family. The fin was reshaped (the leading edge was more sharply swept and unbroken, lacking the small root fillet characteristic of the early versions) and vertical tail area less ventral fin was increased to 5.2 m² (55.97 sq ft).

The 'tail job' underwent testing in 1963 and the results were encouraging, the new fin being recommended for production.

RSK MiG

RSK MiG

▲ **This MiG-21PF (c/n N76210725) served for testing the new broad-chord fin. Note that the brake parachute is still ventrally mounted.**

MiG-21FL export/licence-built interceptor (*izdeliye* 77, Version B)

The MiG-21 started a new tradition within the Mikoyan OKB: export aircraft intended for Warsaw Pact member states were referred to in-house as 'version A', being almost identical in equipment and armament to Soviet Air Force examples, while those intended for non-Warsaw Pact and third-world countries were usually more downgraded and called 'version B'. 'Version B' of the MiG-21PF received a new designation, MiG-21FL, and a separate product code, *izdeliye* 77.

It should be noted that the MiG-21FL differed from the MiG-21PF (both the domestic variety and the export 'Version A') both structurally and as regards equipment. It was the first version to introduce the new vertical tail of 5.2 m² area that had been verified on the abovementioned MiG-21PF c/n N76210725. Additionally, the brake parachute was moved from its usual location below the engine jetpipe to the base of the rudder (see Ye-7SPS below). The powerplant, on the other hand, was downgraded – the MiG-21FL had the older and lower-powered R11F-300 engine. There was no provision for carrying RS-2-US radar-homing AAMs; therefore a simplified version of the RP-21 radar, known as the R1L for export, was fitted. The MiG-21FL's avionics suite included an RSIU-5G VHF radio, an SRO-1 IFF transponder, an ARK-10 ADF (minus DME module), a KSI-2 compass system and an RV-UM radio altimeter.

The MiG-21FL entered production at MMZ No. 30 'Znamya Truda' in 1965; the last Moscow-built example was manufactured in 1968. In 1966 the Indian company Hindustan Aeronautics Ltd. (HAL) started licence production of the MiG-21FL at the aircraft factory in Nasik, Maharashtra; the R11F-300 engine and the avionics were built under licence by other HAL subdivisions. Later on, in the course of licence production, the Indian-built MiG-21FL was fitted with the more capable R2L radar – the export version of the improved RP-21M (see below).

Ye-7SPS development aircraft

As noted in Chapter 2, one of the Mikoyan OKB's efforts to improve the MiG-21 was directed at enhancing the fighter's field performance. In 1961 the Ye-6V/2 development aircraft was equipped with new blown flaps, successfully passing State acceptance trials. The flap blowing system was known as SPS (*sdoov pogra**nich**novo **sloy**a* – boundary layer blowing or BLC). As the MiG-21PF interceptor entered production, the third Gor'kiy-built example (c/n N76210103) was earmarked for BLC system tests, arriving at the OKB's flight test facility in Zhukovskiy shortly after the first aircraft.

The fighter was refitted with an R11F2S-300 (*izdeliye* 37F2S) turbojet featuring air bleed valves aft of the sixth compressor stage to cater for the flap blowing system (hence the S for *sdoov* [*pogranichnovo sloya*]). The engine's maximum afterburner rating of 6,175 kgp (13,610 lbst) was identical to that of the previous version. The BLC system increased the flaps' efficiency, enhancing lift and thereby affording a reduction in approach/landing speed.

Additionally, MiG-21PF c/n N76210103 introduced a new brake parachute system that became a standard fit for production versions from the MiG-21FL onwards. The PT-5759-58 brake parachute (*para**shoot** tormoz**noy***) with

RSK MiG

manufacturer's flight tests and State acceptance trials in the first half of 1962. Thanks to the BLC system and the new brake parachute the landing speed was reduced to 240 km/h (149 mph), the landing run being shortened to some 480 m (1,575 ft). To shorten the interceptor's take-off run the designers incorporated provisions for two 2,500-kgp (5,510-lbst) SPRD-99 JATO boosters, which had proved their worth on the Ye-6V prototypes. The booster nozzles were angled 48°30' outwards and the boosters were jettisoned after the aircraft had reached a specified altitude. The bottom line was that the Ye-7SPS was recommended for production.

▲►
The third production MiG-21PF (c/n N76210103) after conversion into the Ye-7SPS development aircraft with blown flaps. Note the brake parachute housing at the base of the rudder combined with the old narrow-chord fin.

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an area of 16 m² (172.22 sq ft) stowed in a bay with a single door to the left of the ventral fin gave place to a PT-5282-62 parachute with an area of 19 m² (204.51 sq ft). This was stowed in a cylindrical housing at the base of the rudder, the parabolic rear end being vertically split to form clamshell doors. Hence the brake parachute created a pitch-up force when deployed instead of a pitch-down force; this allowed it to be deployed safely when the aircraft was still 0.5-1 m (1.6-3.2 ft) above the ground, reducing the landing run.

Due to its experimental status the aircraft had no radar, which was replaced by test and recording equipment.

Bearing the in-house designation Ye-7SPS, MiG-21PF c/n N76210103 successfully passed

MiG-21PFS production interceptor (Ye-7SPS, *izdeliye* 94; *Fishbed-D*, *Fishbed-F*)

Once the Ye-7SPS prototype (c/n N76210103) had completed its test cycle, the BLC-equipped version of the interceptor entered production at plant No. 21 in Gor'kiy as the MiG-21PFS, the S again referring to the blown flaps (*sdoov* [*pogranichnovo sloya*]). The in-house product code was izdeliye 94; it may as well be said now that the MiG-21PFS was the first of several rather different versions to bear this product code. The first 25 production examples rolled off the assembly line in Gor'kiy in 1963.

As is usually the case, the OKB turned out an incessant stream of design changes and refinements to be incorporated on the MiG-21PFS production line. For instance, from

c/n 940912 onwards the 500 x 180 mm (19.68 x 7.08 in) KT-38 nosewheel with twin expander-tube brakes was replaced by a KT-102 nosewheel of identical size featuring a more effective disc brake. (Note: Some MiG-21PFS construction numbers were quoted without the plant number, consisting only of the product code, the batch number and the number of the machine within the batch.)

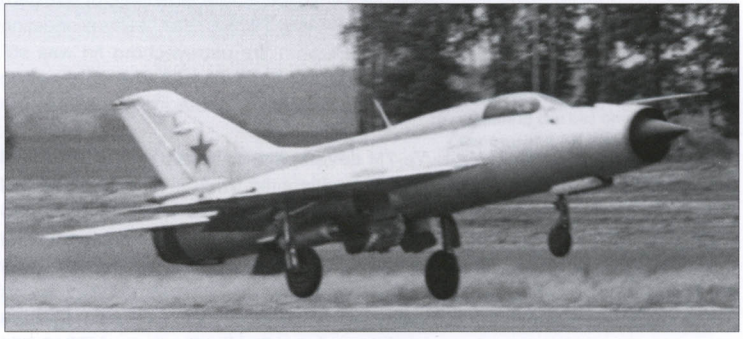
Early-production MiG-21PFSs combined the early-style vertical tail featuring a kinked leading edge with the new brake parachute housing at the base of the rudder; some documents indicate this could accommodate both the PT-21U parachute with an area of 19 m^2 and the smaller PT-21UT with an area of 16 m^2. Such aircraft were few, however; from Batch 10 (c/n 941001) onwards the MiG-21PFS was manufactured with the new large vertical tail patterned on the modified MiG-21PF c/n N76210725. In other words, late-production MiG-21PFSs were almost identical in appearance to the MiG-21FL export version; you had to look closely at the flaps to spot the difference (and that meant coming really close to the aircraft).

Another major change introduced in the course of production was the replacement of the original SK ejection seat with the new SK-3 (alias KM-1) seat having an expanded operational envelope. This brought about a redesign of the cockpit canopy: the forward-hinged hydraulically actuated one-piece canopy incorporating an optically flat windscreen was replaced by a fixed windshield with triangular sidelights and a hinged portion opening manually to starboard. The new windshield left no room for the bulletproof glass panel located inside the old-style canopy (immediately aft of the integral windscreen), which was thus eliminated; there was only a birdproof triplex windscreen.

The KM-1 permitted safe ejection right down to zero altitude at speeds ranging from 130 km/h (81 mph) on take-off/landing to 1,200 km/h (745 mph) in level flight. Pilot gear included a VKK-6 pressure suit with a GSh-6 full-face pressure helmet for high-altitude sorties (replaced by a ZSh-3 'bone dome' flying helmet and a KM-32M oxygen mask for low/medium-altitude sorties) and a VK-3 ventilated flying suit. (ZSh = *za**shchit**nyy shlem* – protective helmet; VK = *venti**lee**ruyemyy kos**tyum*** – ventilated suit.) This configuration applied to MiG-21PFSs.

Thus the MiG-21PFS (Ye-7SPS, *izdeliye* 94) was manufactured in three distinct configurations. The initial version had a MiG-21PF-style narrow-chord tail combined with the brake parachute housing at the base of the rudder. The

RSK MiG



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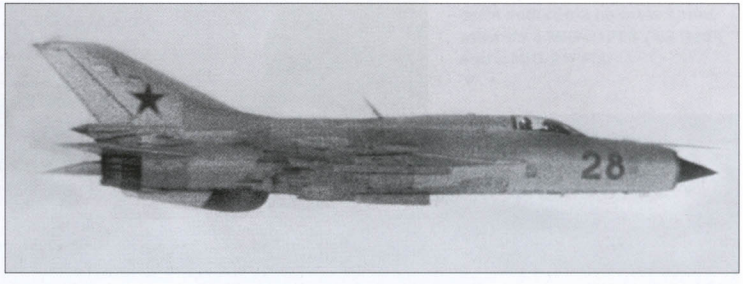
▲▲
The Ye-7SPS (c/n N76210103) with SPRD-99 boosters at the OKB's flight test facility.
▲
The same aircraft takes off at Moscow-Domodedovo during a rehearsal of the 1967 airshow.
Operational MiG-21PFSs '28 Blue' and '40 Red' in cruise flight and on take-off.
▼ ▼▼



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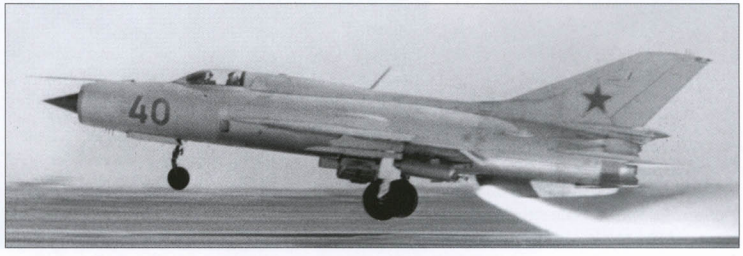

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▲ **'07 White', a narrow-tailed MiG-21PFS operated by the Barnaul Military Pilot College (BVVAUL) in a four-tone tactical camouflage scheme.**

interim version (from c/n 941001 onwards) had the new broad-chord fin but still retained the old one-piece canopy design and SK ejection seat, being a MiG-21FL look-alike. Finally, the ultimate variant (from c/n 941221 to c/n 941301 and from c/n 941314 onwards) had the new two-piece canopy and KM-1 ejection seat. The new vertical tail did not escape the attention of Western observers and, while the early-production MiG-21SPS with the narrow-chord fin was still referred to as the *Fishbed-D*, the late version was code-named *Fishbed-F*.

Ye-7M development aircraft

The improvements made in the course of MiG-21PF (and subsequently MiG-21PFS) production concerned not only the structure but the interceptor's equipment as well. The Ye-7SPS was followed by the Ye-7M (*modernizeerovannyy* – updated), which had an upgraded targeting system. The interceptor was fitted with a compact ASP-PF computing sight, which was integrated with the RP-21 radar and a *Samotsvet* (an old Russian word for 'gem') forward-looking infrared (FLIR) seeker. The ASP-PF sight received target range inputs from the radar, allowing the pilot to fire his missiles accurately and deliver rocket or bomb strikes in daylight VMC conditions. The FLIR detected the target at night and permitted targeting regardless of the flight level.

The Ye-7M was converted from the Ye-7SPS development aircraft (c/n N76210103), which had completed its State acceptance trials by then and was available for modification. First of all, the test and recording equipment housed in the forward avionics bay was removed and the RP-21 radar was reinstated. The bulletproof windscreen inside the canopy was deleted to make room for the Samotsvet FLIR and the ASP-PF sight; the latter supplanted the standard radarscope, which was moved to a new location. This required the main instrument panel and the side control consoles to be redesigned; changes were also made to the transverse beam in the cockpit supporting the instrument panel.

The Ye-7M was fitted with the K-51 weapons system. Thus, the standard BD3-60-21U wing pylons could carry either APU-13 launch rails for K-13 IR-homing AAMs or PU-12-40 launch rails for RS-2-US radar-homing AAMs; alternatively, APU-7 launch rails could be fitted.

RSK MiG

RSK MiG

►►▲ **The Ye-7SPS (c/n N76210103) following conversion into the Ye-7M prototype. The new wide-chord fin with a dielectric insert at the top is clearly visible.**

RSK MiG

The avionics included an SRZO-2M Khrom-Nikel' IFF interrogator/transponder and an ***Is**kra* (Spark) short-range radio navigation system. The rear avionics bay was enlarged by cropping the upper portion of the No. 1 fuselage fuel tank to accommodate the additional equipment, and an extra access hatch was provided to starboard symmetrically to the existing one on the port side. Finally, the canopy was provided with a rear view mirror.

The modification work was completed on 17th October 1962. Just over two months later, on 27th December, the Ye-7M was submitted for joint State acceptance trials. Concurrently the aircraft participated in the trials of the K-51 weapons system, the greater part of which was performed on the first production MiG-21PF.

The trials revealed certain deficiencies in the RP-21 radar and the ASP-PF sight, which had to be modified. Nevertheless, the results were generally encouraging and the Ye-7M was recommended for production in 1964.

MiG-21PFM production interceptor (Ye-7SPS, Ye-7M, *izdeliye* 94; *Fishbed-F*)

It took a while to introduce the Ye-7M's new targeting system on the production line. Starting from Batch 20, the MiG-21PFS interceptor produced in Gor'kiy received a major systems upgrade and a new service designation, MiG-21PFM; again, the M stood for *modern-**izee**rovannyy*. The aircraft was fitted with the upgraded RP-21M radar linked to a PKI collimator gunsight; the avionics suite included an SRZO-2 IFF interrogator/transponder, an RV-UM radio altimeter, an ARK-10 ADF with a DME module, and a KAP-2 autopilot. The KM-1 ejection seat was modified to make it more easily adjustable to the pilot's stature. A new PT-21UK brake parachute was used.

▲
An early-production MiG-21PFM retaining the old one-piece canopy and SK ejection seat.

Soviet pilots wearing VK-3 flight suits and ZSh-3 helmets sprint towards a MiG-21PFS ('69 Red') and a MiG-21PFM.
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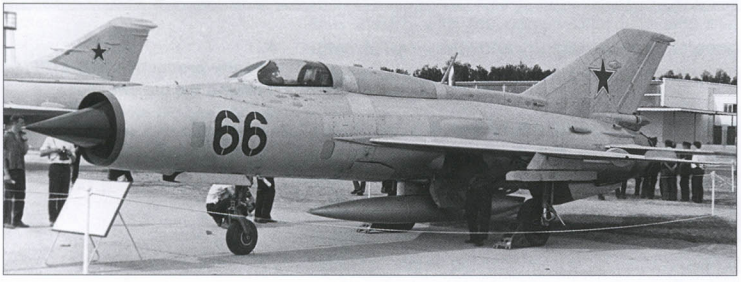


▲▲ **'66 Red', an early-production MiG-21PFM (note the lack of the dielectric fin cap), taxies out for take-off.**

▲ **A different MiG-21PFM with the same code (note the different style of the digits) in the static display at Moscow-Domodedovo on 9th July 1967.**

An important new feature of the MiG-21PFM was the reinstatement of cannon armament. This time, however, the cannon was not internal, and of a different type than hitherto. Instead of the usual centreline pylon the fighter could be fitted with the GP-9 cannon pod (*gon**dola** **push**echnaya*) accommodating a 23-mm (.90 calibre) Gryazev/Shipunov GSh-23 cannon with 200 rounds. This twin-barrel cannon was a highly effective weapon with a high rate of fire. As was the case with the MiG-21PFS, SPRD-99 JATO boosters could be fitted.

As you see, quite enough changes had been made to warrant a new service designation. Somewhat surprisingly perhaps, the MiG-21PFM was still referred to in-house as the Ye-7SPS and retained the old product code *izdeliye* 94.

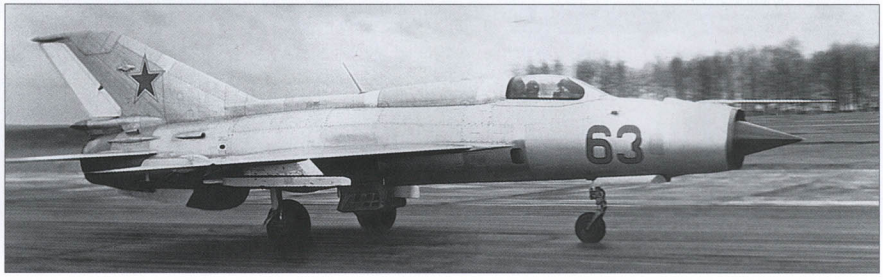
Shortly before the switch to MiG-21PFM production the construction number system at plant No. 21 changed. For security reasons a system was contrived to conceal the batch number and hence production volumes. It was based on a code word, *samo**lyot**chik*. Depending on the context, this slang word means either 'airman or ground crewman operating fixed-wing aircraft' (as opposed to *verto**lyot**chik* – ditto but operating helicopters) or 'airframer' (as opposed to the engine/avionics/weapons makers). A number from 0 to 9 (**not** 1 to 0, as sometimes asserted!) corresponded to each letter of the code word (in Cyrillic characters):

С	А	М	О	Л	Ё	Т	Ч	И	К
S	A	M	O	L	Yo	T	Ch	I	K
0	1	2	3	4	5	6	7	8	9

Thus the batch numbers were substituted by letter combinations. Batch 01 equalled SA (CA), Batch 04 equalled SL (СЛ), Batch 07 equalled SCh (СЧ) and so on. Hence the first production MiG-21PFM was c/n 940MS01 (or 940MC01 in Cyrillic characters).

Additionally, MiG-21s with c/ns in this system have four-digit *fuselage numbers* (f/ns) or *line numbers* consisting of the batch number and the number of the machine in the batch; security is all very well but the manufacturer has to keep track of production, after all. Most of the Soviet/CIS aircraft design bureaux use the term *se**reey**nyy* ***nom**er* for fuselage numbers; this is derived from the word ***ser**iya* in the meaning 'production batch'. The Mikoyan OKB, however, invented its own term, referring to the f/n as ***nom**er kom**plek**ta agre**gah**tov* ('subassembly set number') in similar manner to the 'set numbers' used by Hawker Siddeley for the Andover transport. Thus, the abovementioned MiG-21PFM c/n 940MS01 is f/n 2001, while MiG-21PFS c/n 940ACh17 (940АЧ17) is f/n 1717.

Interestingly, once the MiG-21PFM designation had been introduced, the Soviet Air Force started applying it retroactively to existing late-



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▶ **One more early MiG-21PFM ready to take off.**

production MiG-21PFSs with the broad-chord tail, new canopy and SK-1 ejection seat – simply because the two versions were outwardly identical and both versions were called *izdeliye* 94. Thus, the same Ye-7SPS interceptors pertaining to batches 10 through 19 may be referred to as 'MiG-21PFS (*izdeliye* 94)' in early documents, which is correct, and as 'MiG-21PFM (*izdeliye* 94)' in later documents – which, strictly speaking, they are not.

NATO saw no difference either. Like the ultimate broad-tail version of the MiG-21PFS, the MiG-21PFM was code-named *Fishbed-F*.

In 1965 GNIKI VVS performed check-up trials of a production MiG-21PFM (identity unknown); oddly, the aircraft was referred to as a 'MiG-21PF with boundary layer control' in the institute's paperwork. The trials revealed that maximum range had dropped from 1,550 to 1,300 km (from 963 to 807 miles) and the service ceiling was reduced from 19,000 to 18,050-18,250 m (from 62,335 to 59,220-59,875 ft) as compared to the prototype. The shortfall in range was due mainly to the increase in the R11F2S-300's specific fuel consumption as the engine was being brought up to production standard; also, the fuel load of production aircraft with blown flaps was reduced by 120 kg (265 lb) because of the need to make room for additional equipment. The lower service ceiling was due to the production fighter's 160 kg (350 lb) higher all-up weight and the variance in thrust between individual engines.

The bulk of MiG-21PFS/MiG-21PFM (*izdeliye* 94) production at the Gor'kiy aircraft factory was in 1964-66, with 320 examples being completed in 1964, 397 in 1965 and 202 in 1966. Soviet Air Force units flying the type included the fighter regiment stationed at Kubinka airbase west of Moscow; the Air Force's display team staffed with the unit's pilots awed the spectators during the airshow at Moscow-Domodedovo on 9th July 1967.

Like their predecessors, the MiG-21PFS and MiG-21PFM saw service with VVS and PVO fighter units alike. However, even though the MiG-21PFS/MiG-21PFM had strike capability (in theory), its combat efficiency in the strike role proved to be rather low. On the other hand, the Soviet Air Force's tactical arm (FA – *Frontova**ya** avia**ht**siya*) urgently needed new weapons enabling pinpoint strikes. Hence on 12th March 1966 MAP issued an order titled 'On expanding the tactical envelope of the MiG-21 aircraft'. This document tasked the Mikoyan OKB with modifying the MiG-21 in order to integrate the Kh-66 air-to-surface missile. The Kh-66 was a beam-riding weapon having considerable commonality with on the RS-2-US AAM; it was to work with an updated targeting system based on the RP-21M radar.

Chris Lofting

Sergey Scrynnikov

▲▲
An early-production MiG-21PFM in non-authentic camouflage with the symbolic code '01 Red' on display in the Great Patriotic War Museum in Kiev.

▲
This early-production MiG-21PFM (again in spurious colours) is preserved in the base museum at Kubinka AB near Moscow. Note the deflector strake under the auxiliary blow-in door.

The 'enhanced tactical envelope' version of the MiG-21 was to be submitted for State acceptance trials in July 1966; yet the work lagged behind schedule, and it was not until autumn that the aircraft was ready for testing. In September 1966 a modified MiG-21PFM made a series of successful test launches of the Kh-66 ASM; depending on the fighter's flight mode, the missile had a 'kill' range of 3-10 km (1.86-6.2 miles) and could be launched from anywhere between 500 and 5,000 m (1,640-16,400 ft). Apart from Mikoyan OKB test pilots Mikhail M. Komarov, Pyotr M. Ostapenko and Aviard G. Fastovets, the weapons tests involved GNIKI VVS test pilots G. A. Gorovoy, V. S. Kotlov, V. G. Plyushkin and M. I. Bobrovitskiy.

After a few revisions to the design the Kh-66 missile was cleared for production and included into the FA inventory in 1968. During a firepower demonstration for the members of the government, V. G. Plyushkin flying a MiG-21PFM demonstrated the capabilities of the new weapons system to advantage, knocking out the target (an air defence radar) with a Kh-66 on the first try. Yet, even though many operational MiG-21PFMs were upgraded with ASM

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▲ **A late-production MiG-21PFM seen at GNIKI VVS in Akhtoobinsk illustrates the definitive two-piece canopy.** ▼ ▼ ▼

capability at the Air Force's aircraft repair plants, their efficiency in the strike role remained fairly low. This was due primarily to the poor performance of the Kh-66 missile itself, which had a low guidance accuracy and could only be launched in good visibility conditions. Also, although the MiG-21PFM could launch both Kh-66s in a salvo (read: get rid of them fast), the carriage of these missiles imposed severe limits on the flight envelope and complicated flying considerably.

Why, then, was the Kh-66 integrated on the MiG-21PFM in the first place? The answer lies in the fact that the Su-7B/Su-7BM/Su-7BKL fighter-bomber and the initial version of its 'swing-wing' Su-17 derivative had no radar and hence lacked the capability to launch beam-riding missiles. Other, more effective air-to-ground weapons, such as laser-guided ASMs, were still under development at the time. That left the radar-equipped MiG-21PFM as the only possible delivery vehicle for the Kh-66, since the latter, as already mentioned, was basically similar to the RS-2-US AAM.

MiG-21PFMs delivered to the Soviet Union's Warsaw Pact allies also had the Kh-66 missile integrated. Yet this missile was used extremely rarely outside the USSR.

MiG-21PFM export interceptor (MiG-21PFM Version A, Ye-7SPS, *izdeliye* 94A; *Fishbed-F*)

The export version of the MiG-21PFM was initially designated '*izdeliye* 94 Variant A', though this code was soon changed to *izdeliye* 94A. The equipment fit varied, depending on the country the fighters were supplied to. Thus, MiG-21PFMs delivered to Warsaw Pact members and other 'friendly nations' lacked the capability to carry S-24 heavy unguided rockets and ZB-62 napalm tanks; the SRZO-2 IFF interrogator/transponder lacked the *Zarya* (Dawn) module standard for Soviet examples. Early MiG-21PFMs (*izdeliye* 94A) were fitted with the older RP-21 radar, and the list of compatible weapons was limited to R-3S AAMs, rocket pods with S-5 FFARs and the GP-9 cannon pod (although the latter was not fitted to some early aircraft). Later deliveries came with the RP-21M or RP-21MA radar and the weapons range was expanded to include the RS-2-US AAM and the Kh-66 ASM.

As already mentioned, a number of East German Air Force MiG-21PF (*izdeliye* 76 Variant A) fighters were modified locally and allocated the unofficial designation 'MiG-21PFM'. When the EGAF started taking delivery of the *real* MiG-21PFM (that is, *izdeliye* 94A), a problem arose – the duplication of 'true and false' designations led to confusion. The East Germans resourcefully invented another home-grown designation, henceforth referring to the MiG-21PFM (*izdeliye* 94A) as the 'MiG-21SPS', making a cross-breed of the service designation and the manufacturer's designation Ye-7SPS –

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just to reflect the fact that the new aircraft had blown flaps. Later still, when upgraded MiG-21PFMs wired to carry the GP-9 cannon pod started arriving, the EGAF invented another unofficial designation, calling such aircraft 'MiG-21SPS-K' (the K suffix stood for *Kanone* – the German word for 'cannon'). The Germans were not the only ones to resort to such tricks; the MiG-21 had unofficial local designations elsewhere, too.

M-21 and M-21M (MiG-21Ye) target drones

In the 1960s a number of aircraft types being phased out by the VVS and the PVO, as well as high-time examples of then-current types, were converted into remote-controlled target drones with performance high enough to meet the demands of the day. In particular, in the mid-1960s the Mikoyan OKB teamed up with the State Special Design Bureau for Sports Aircraft (GSKB SA – *Gosoo**dar**stvennoye spetsi**ahl'**noye kon**strook**torskoye byu**ro** spor**tiv**noy avi**aht**sii*), a division of the Kazan' Aviation Institute, to convert time-expired MiG-21PFs into target drones for the benefit of fighter pilots and surface-to-air missile (SAM) crews honing their skills. (In the early 1980s GSKB SA was renamed the Sokol (Falcon) OKB and still exists as such, specialising in target drone design.) The drone could be controlled either from the ground or from another aircraft acting as a drone director. The researchers and flight test personnel of GNIKI VVS also played a major part in shaping the ideology of the drone control system.

BVVAUL

Scherbacevich

The conversion boiled down to removing the radar and part of the equipment (including the oxygen system), as well as one of the fuselage fuel tanks, in order to make room for the remote control system. In particular, an automatic control system incorporating an AP-17 autopilot was installed in place of the radar set, feeding control inputs to servos connected to the control runs. A dispenser with decoy flares was fitted to emulate enemy infrared countermeasures (IRCM). A special system registering hits and misses was fitted (it could record how far off target the incoming missile was – if it was). A

▲▲ **'Chocks away' for MiG-21PFM '161 Red', a late example operated by BVVAUL. Note the 'Excellent Aircraft' maintenance award badge on the nose.**

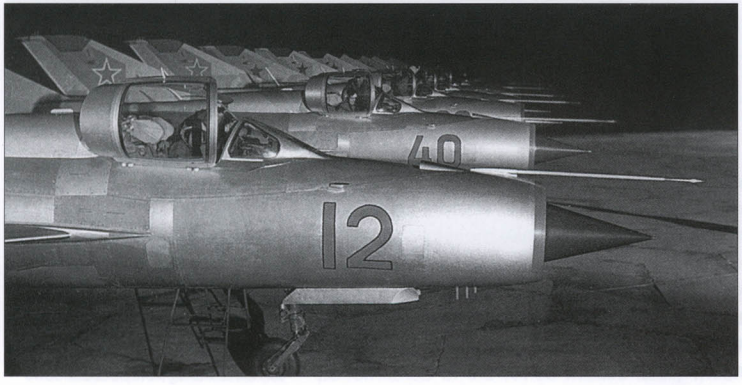
▲ **'155 Red', another late-production MiG-21PFM relegated to the training role, in four-tone camouflage colours.**

An early-production MiG-21PFM operated by Sqn 4 of the 234th GvIAP (the display team at Kubinka AB)

A late-production MiG-21PFM (probably operated by the Barnaul Military Pilot College)

G.Omel'chuk

G.Omel'chuk



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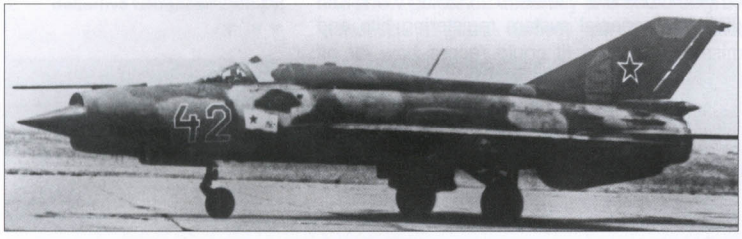

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A practice scramble of a fighter unit at Kubinka AB flying late-production MiG-21PFMs.

▲
A MiG-21PFM operated by a Soviet Navy fighter-bomber unit.

M-21 (left) and M-21M (right) target drone prototypes. Note the ventral guidance antenna pod.

◄▼ ▼

G.Omel'chuk

tracking system allowed the drone's trajectory to be observed and recorded from the ground. Tracers facilitating visual identification in the daytime were installed on short pylons on the rear fuselage. Another system allowed the drone to take off from *ad hoc* airstrips just 40 m (130 ft) wide. The ejection seat was retained because the drone had to be test flown after the conversion before being used for its intended purpose.

Once a prototype conversion had been tested successfully at GNIKI VVS in Akhtoobinsk, a set of documents for the conversion of retired MiG-21s into drones was handed down to the Air Force's aircraft repair plant in L'vov, the Ukraine. This plant had previously undertaken similar conversion work, supplying the Air Force with MiG-15M (alias M-15) and MiG-17M (alias M-17) drones.

Designated M-21 (the M stood for *mi**shen'*** – target) or MiG-21Ye, the drone conversion of the MiG-21PF was almost identical outwardly to the basic fighter, the remote control system aerials under the forward fuselage and the tracers near the tail being the only identification features. As available time-expired MiG-21PFs were used up, decommissioned MiG-21PFMs were allocated for conversion to drones; such aircraft were designated M-21M, the M suffix denoting *manev**ree**ruyushchaya* (manoeuvring) and referring to the ability to take evasive action. The M-21M had a 8,400-kg (18,520-lb) take-off weight; it could operate at altitudes anywhere between 50 and 14,400 m (164-47,240 ft) and had a maximum speed of 1,800 km/h (1,118 mph);

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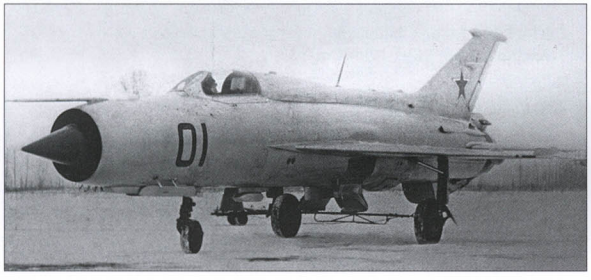
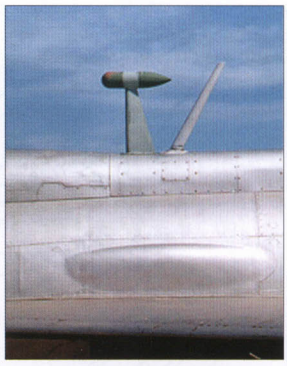


RSK MiG

Sergey Scrynnikov



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An M-21 drone (the low-visibility tactical code '33 Red outline' is almost obliterated) at GNIKI VVS in Akhtoobinsk and a close-up of the strut-mounted guidance system antenna pod on this aircraft.

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One of the tracer holders on the M-21's rear fuselage.

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M-21M '03 Red outline' (c/n 940 OCh 22?) at GNIKI VVS. Note the antennas under the nose.

Another M-21M at Akhtoobinsk.

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A rather odd publicity picture of a MiG-21PFM with a 'peephole effect'.

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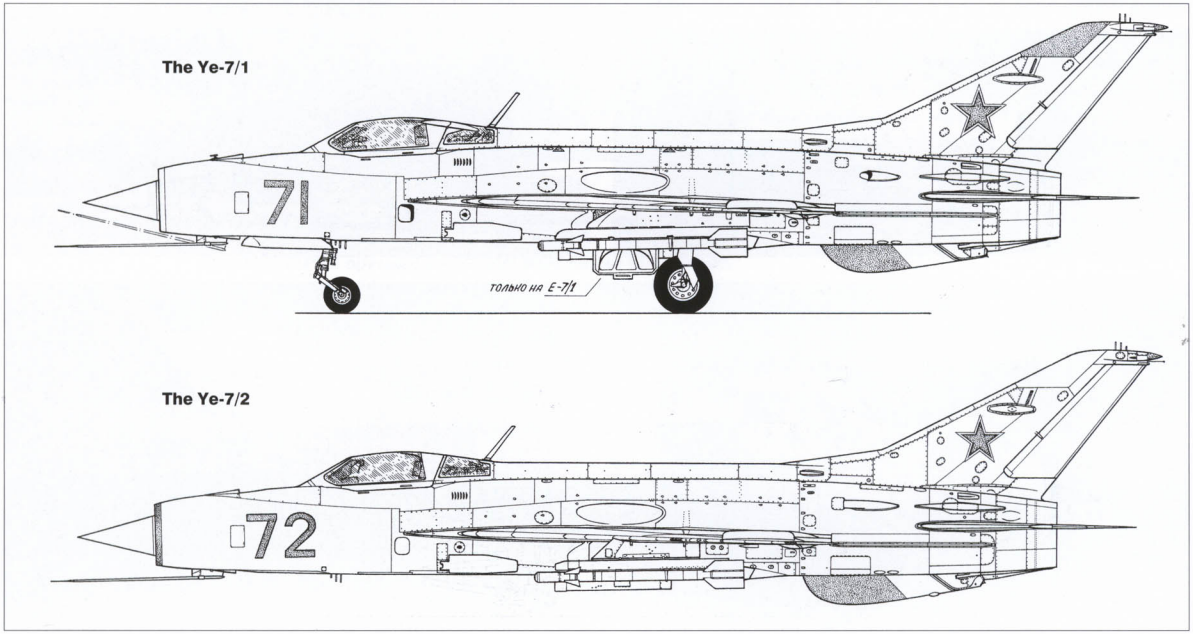
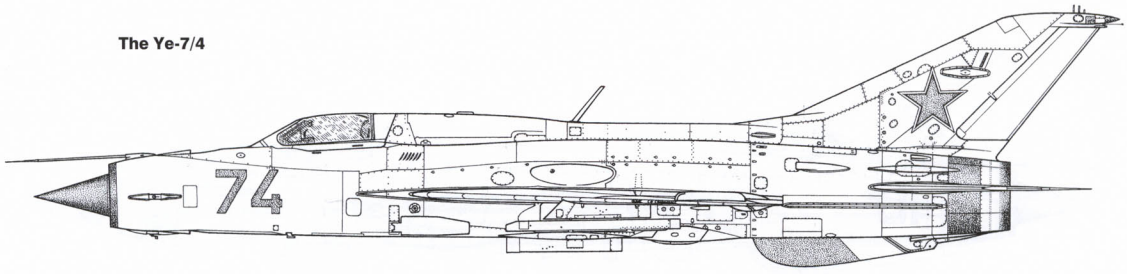
The drone could pull 8.5 Gs during evasive manoeuvres and stay aloft for up to 106 minutes. Manoeuvring was restricted to subsonic speeds, however. Take-off was possible from paved and unpaved runways alike.

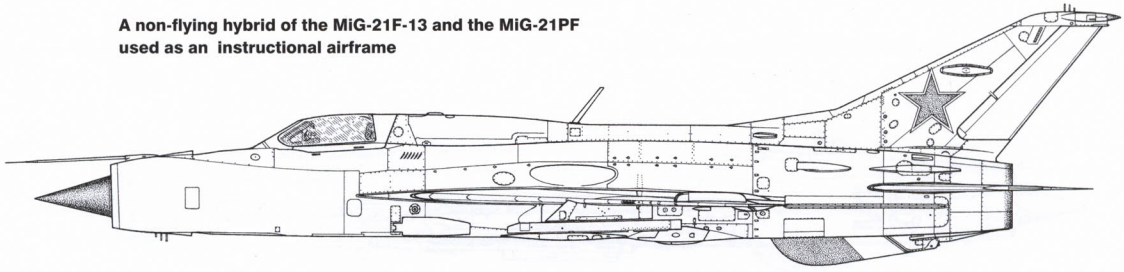
M-21 and M-21M drones are still in limited use today. A few remain at the Russian Air Force's 929th State Flight Test Centre (GLITs – *Gosoo**dar**stvennyy **lyot**no-ispy**tah**tel'nyy tsentr*) in Akhtoobinsk – the former GNIKI VVS.



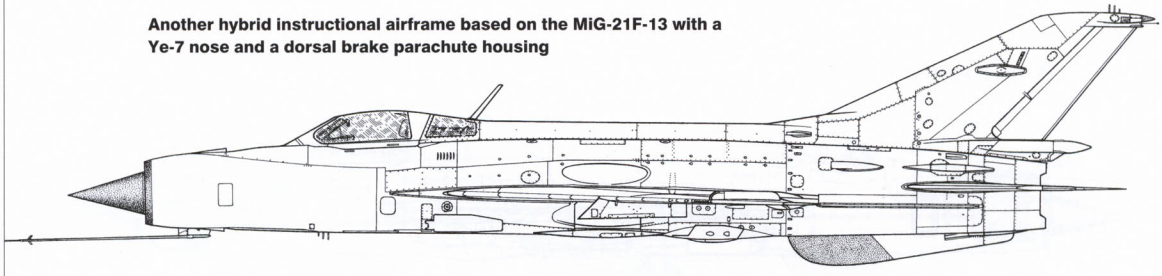
The Ye-7/4



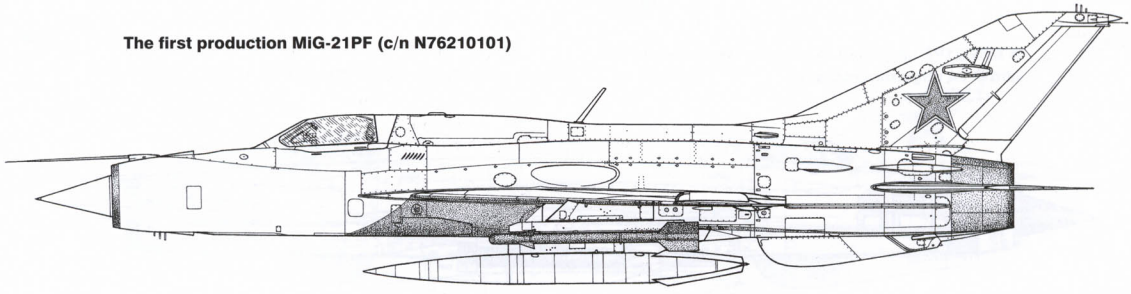
A non-flying hybrid of the MiG-21F-13 and the MiG-21PF used as an instructional airframe



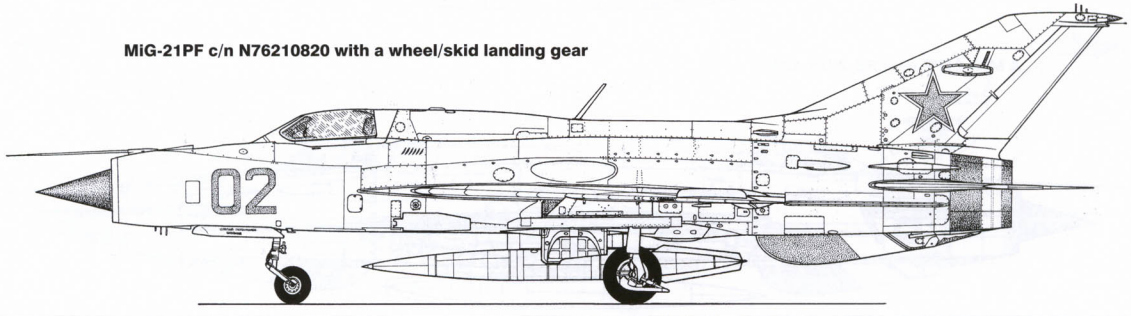
Another hybrid instructional airframe based on the MiG-21F-13 with a Ye-7 nose and a dorsal brake parachute housing



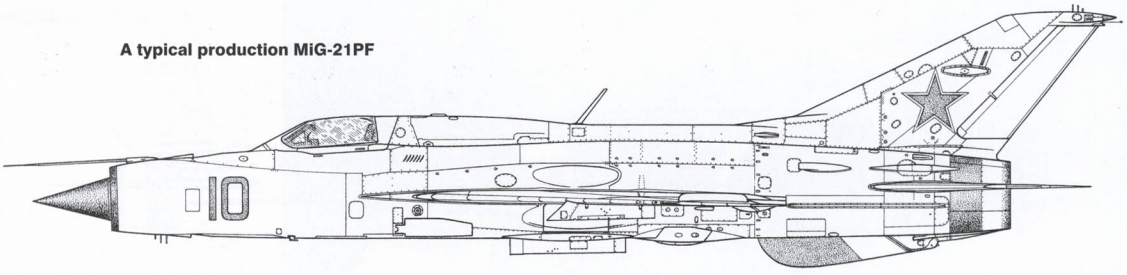
The first production MiG-21PF (c/n N76210101)



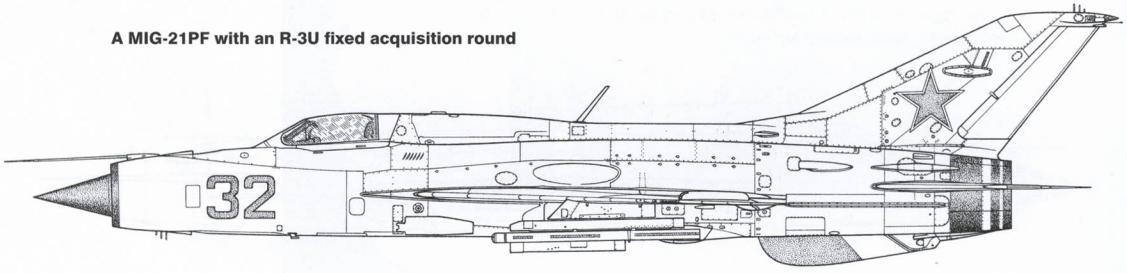
MiG-21PF c/n N76210820 with a wheel/skid landing gear



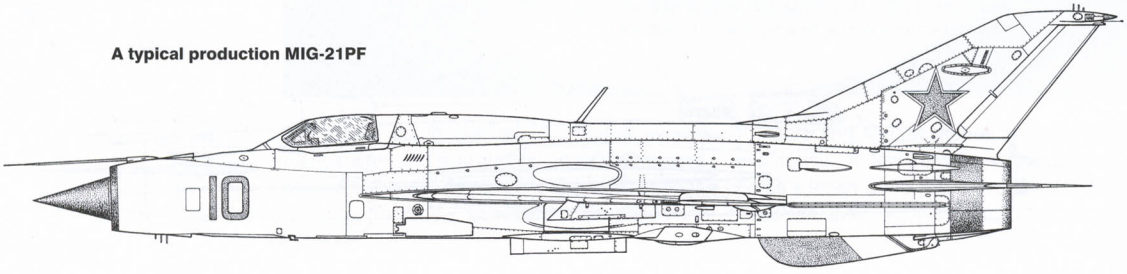
A typical production MiG-21PF



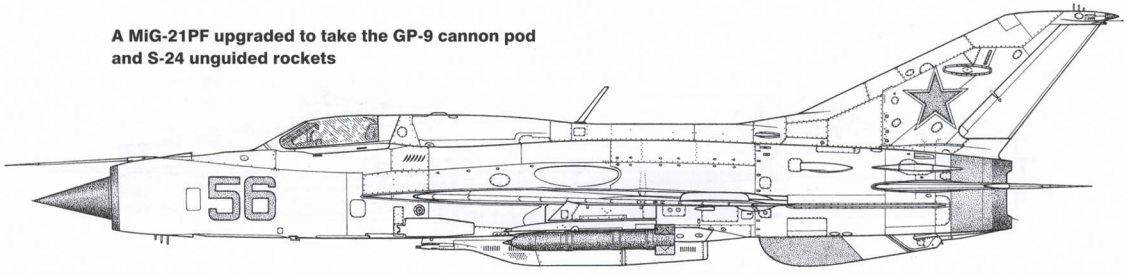
A MIG-21PF with an R-3U fixed acquisition round



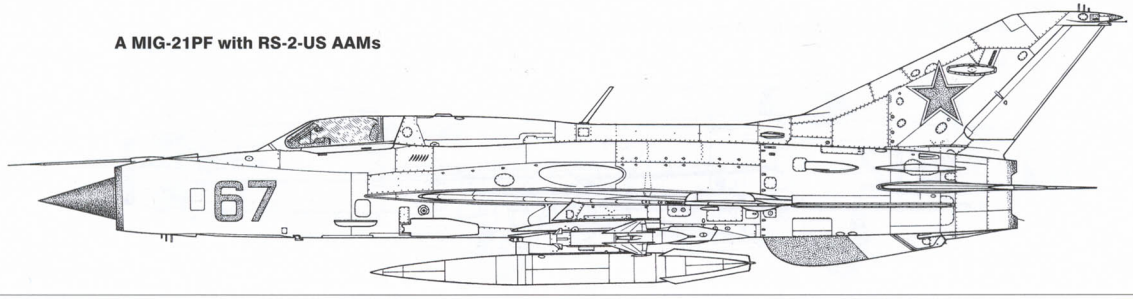
A typical production MIG-21PF



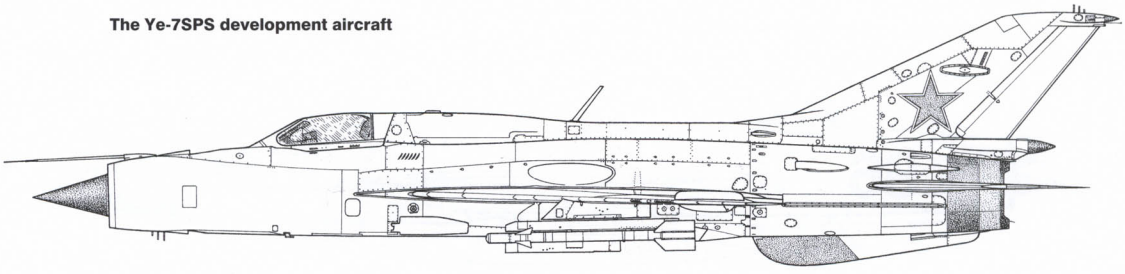
A MiG-21PF upgraded to take the GP-9 cannon pod and S-24 unguided rockets



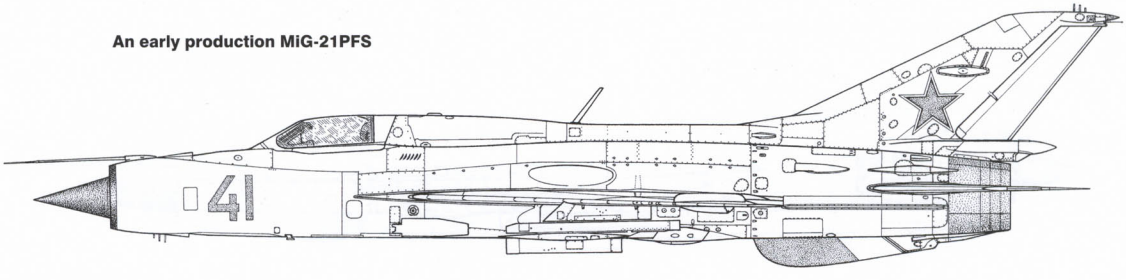
A MIG-21PF with RS-2-US AAMs



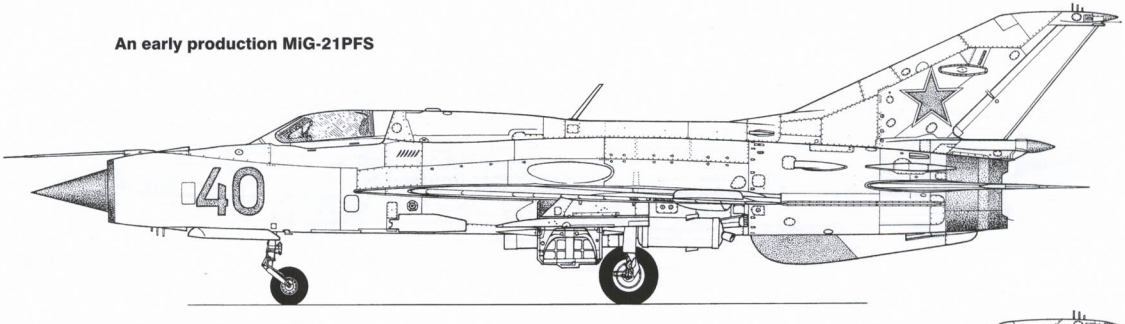
The Ye-7SPS development aircraft



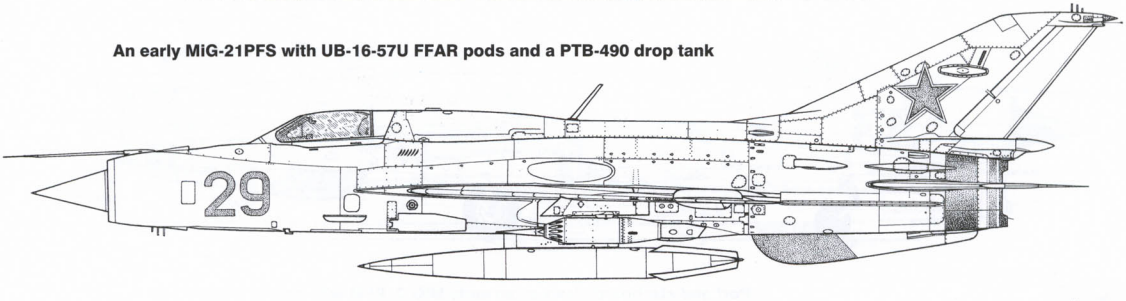
An early production MiG-21PFS



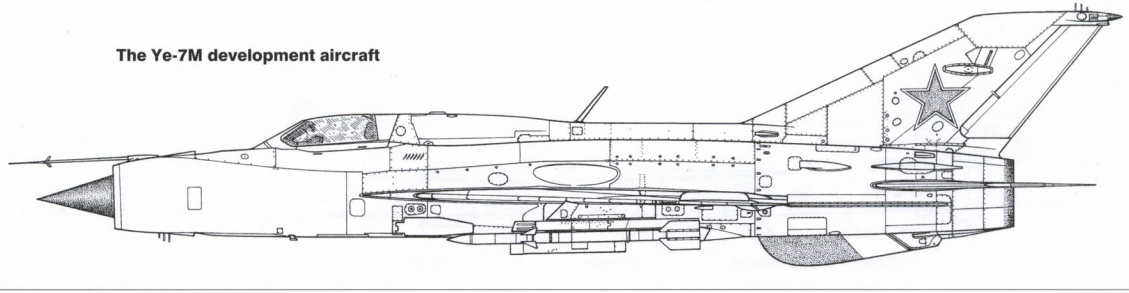
An early production MiG-21PFS



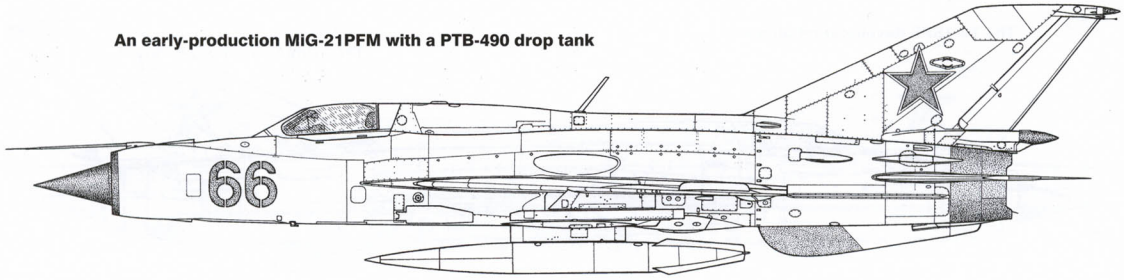
An early MiG-21PFS with UB-16-57U FFAR pods and a PTB-490 drop tank



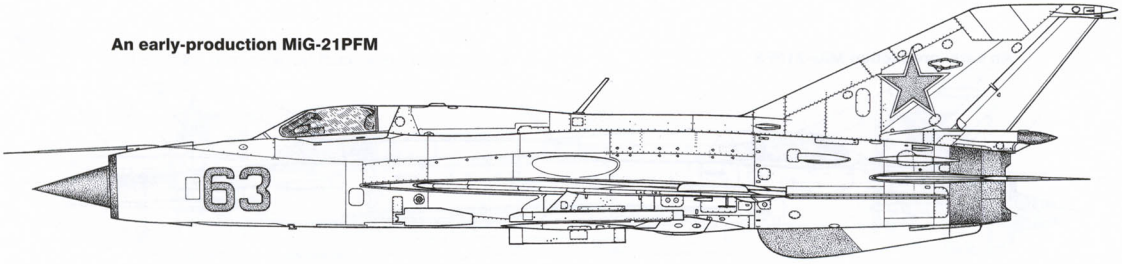
The Ye-7M development aircraft



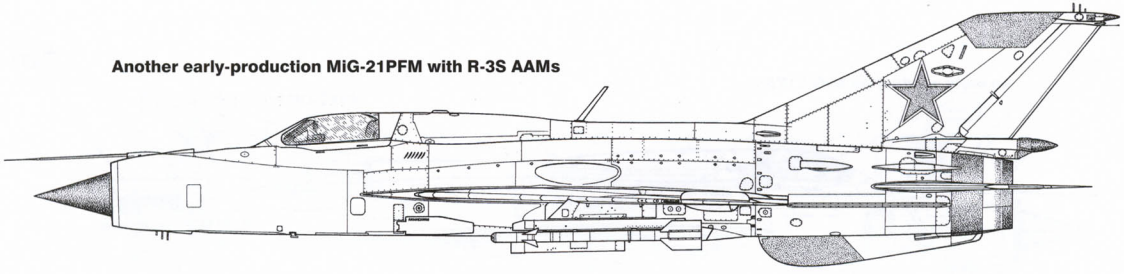
An early-production MiG-21PFM with a PTB-490 drop tank

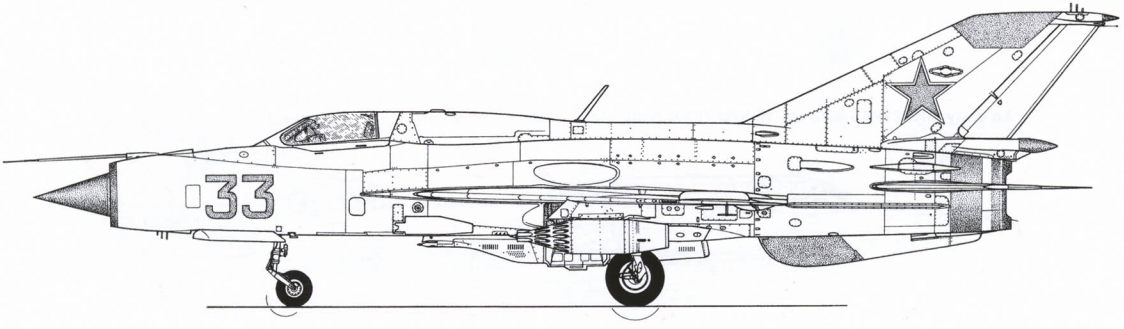


An early-production MiG-21PFM

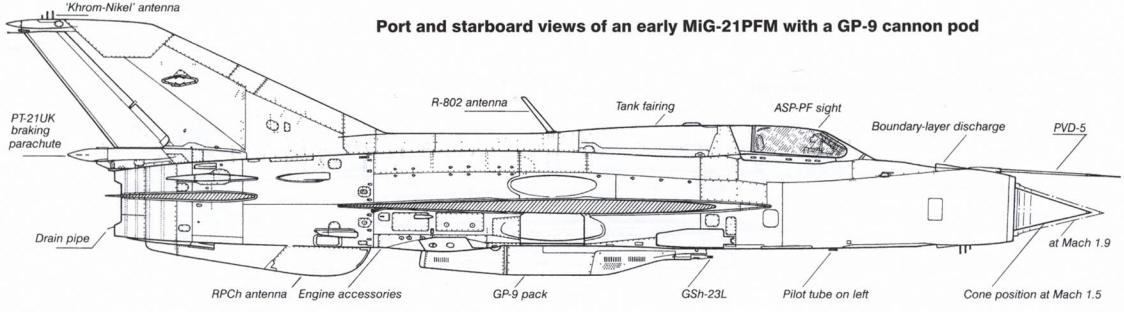


Another early-production MiG-21PFM with R-3S AAMs

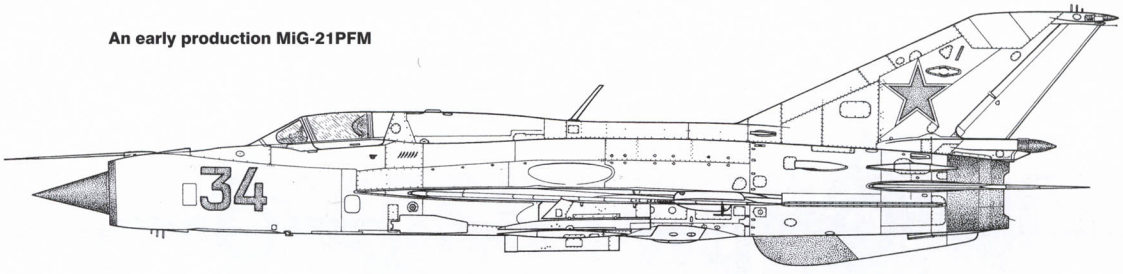




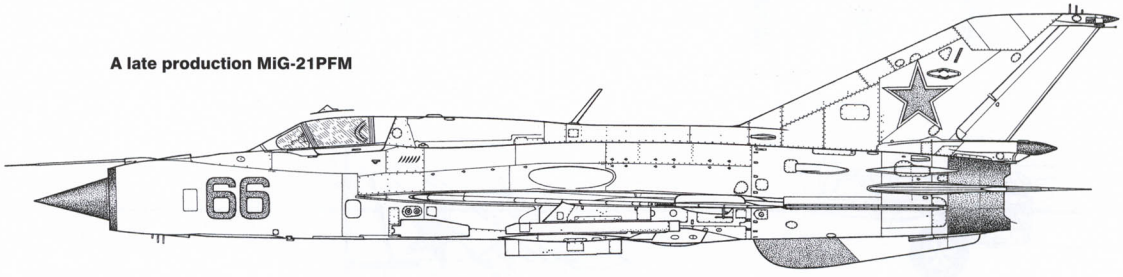
Port and starboard views of an early MiG-21PFM with a GP-9 cannon pod



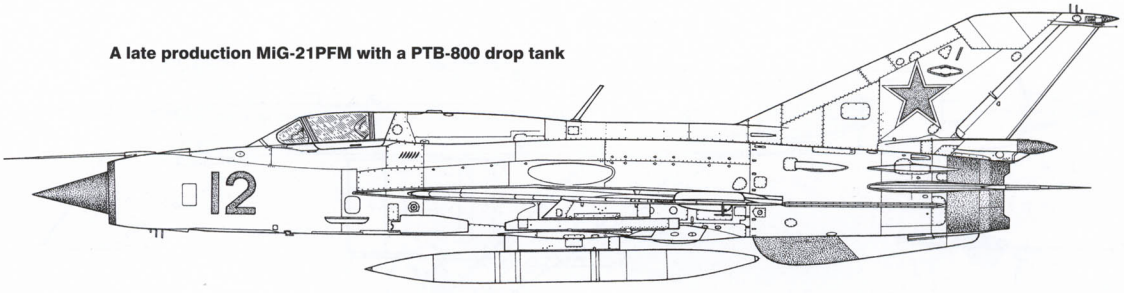
An early production MiG-21PFM



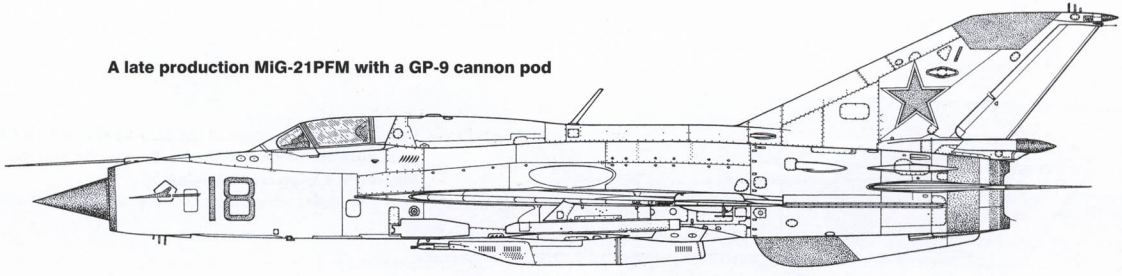
A late production MiG-21PFM



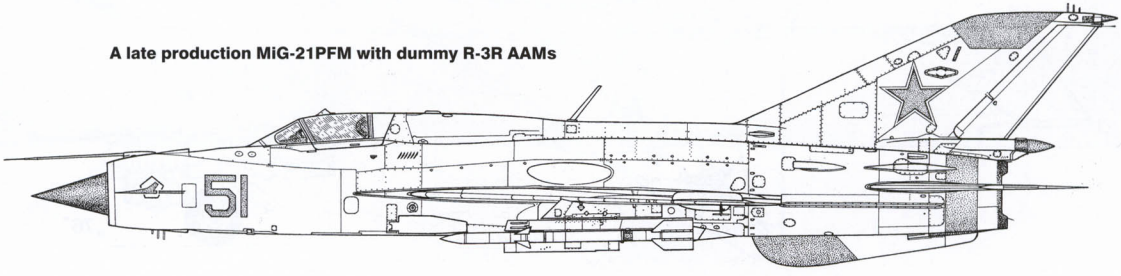
A late production MiG-21PFM with a PTB-800 drop tank

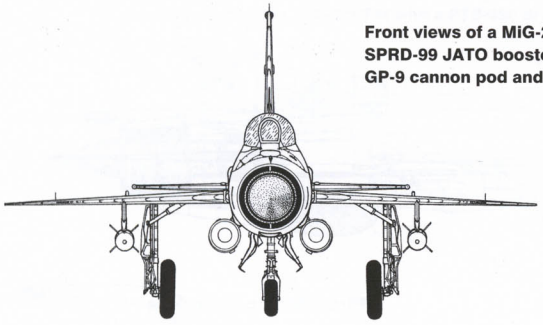


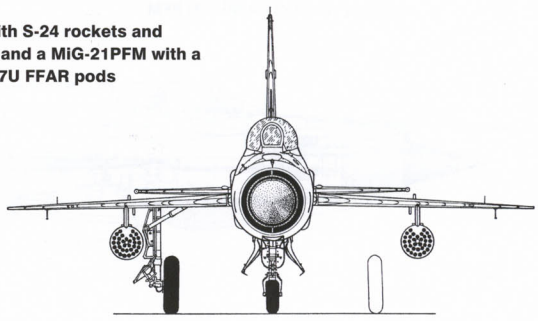
A late production MiG-21PFM with a GP-9 cannon pod



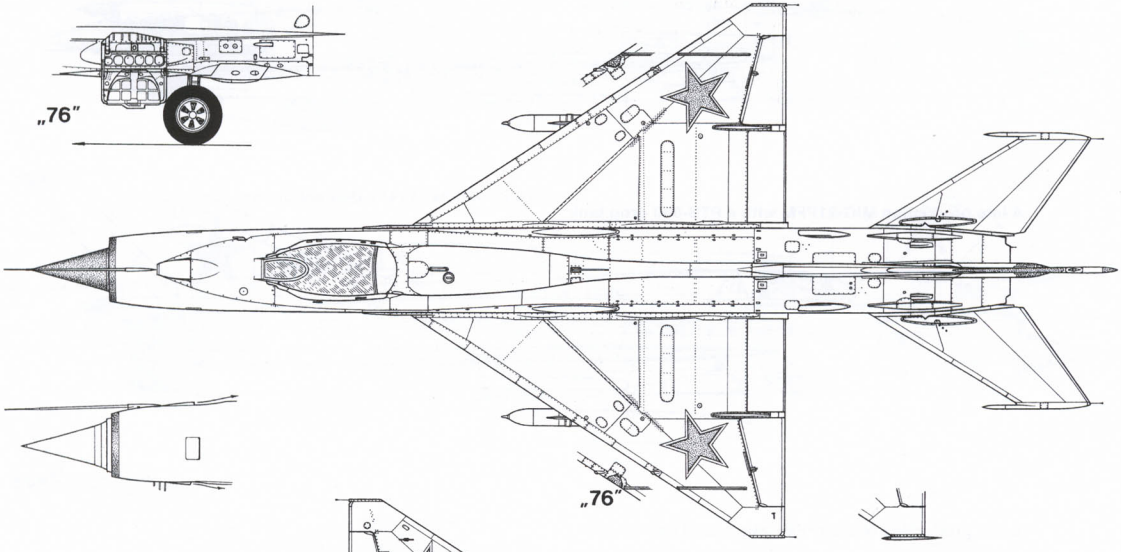
A late production MiG-21PFM with dummy R-3R AAMs

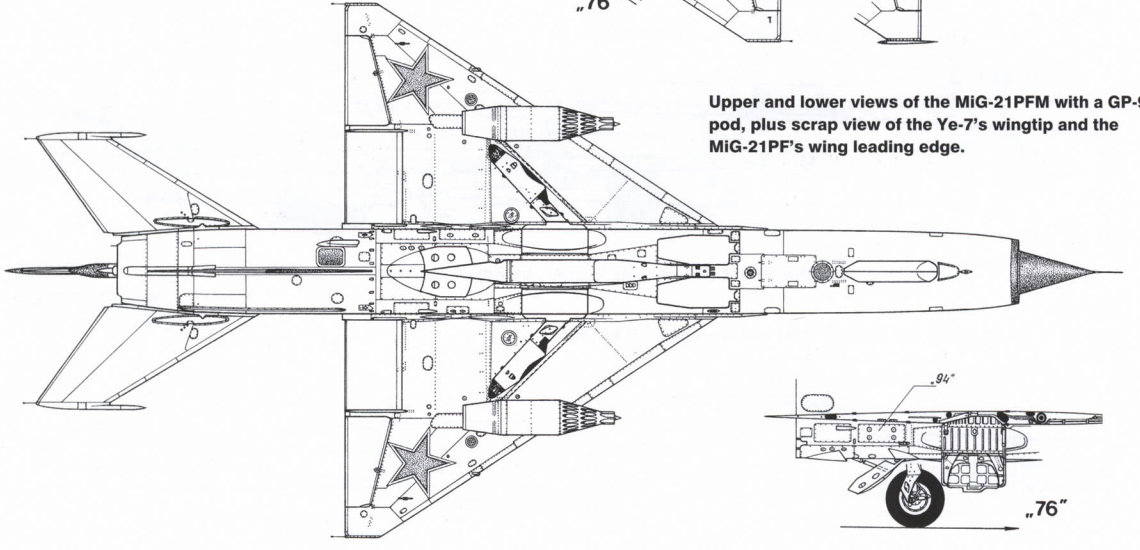






Front views of a MiG-21PFS with S-24 rockets and SPRD-99 JATO boosters (left) and a MiG-21PFM with a GP-9 cannon pod and UB-16-57U FFAR pods





Upper and lower views of the MiG-21PFM with a GP-9 pod, plus scrap view of the Ye-7's wingtip and the MiG-21PF's wing leading edge.

PART FOUR

MASS PRODUCTION

MiG-21R (Ye-7R) tactical reconnaissance aircraft prototypes

In the early 1960s the reconnaissance component of the Soviet Air Force's tactical arm (FA) relied on obsolescent types – the Il'yushin IL-28R *Beagle*, the Yakovlev Yak-27R *Mangrove* and the MiG-19R *Farmer-C*, which was in service in limited numbers (the R stood for [*samo**lyot***-] *raz**ved**chik* – reconnaissance aircraft). The Mikoyan OKB thus suggested developing an all-weather supersonic tactical reconnaissance aircraft based on the MiG-21 tactical fighter – an idea which the Air Force supported.

A Ye-7R (MiG-21R) prototype seen during trials with the Type R ELINT pod. The aircraft is a converted early-production MiG-21PFS with one-piece canopy and narrow-chord fin. No wing pylons are fitted.
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▲
'20 Red', one of the Ye-7R prototypes. Again, it has the old canopy, spine and tail design, as well as a centrally mounted PVD-5 pitot boom.

The aircraft was derived from the production MiG-21PFS (Ye-7SPS) interceptor, receiving the manufacturer's designation Ye-7R. The mission equipment was carried externally in interchangeable pods allowing the aircraft to be configured for daylight or night photo reconnaissance (PHOTINT), electronic intelligence (ELINT), laser imaging, infrared imaging (IRINT) and TV imaging. Hence appropriate changes were made to the electric circuitry and the project envisaged installing an AP-155 three-channel autopilot developed in-house instead of the KAP-2 autopilot serving only the roll channel.

The Ye-7R's main mission was daylight and night tactical PHOTINT and ELINT at low and medium altitudes. The aircraft could also operate as an interceptor, in which case the reconnaissance pod was not fitted.

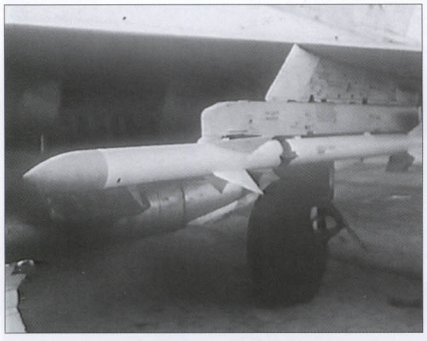
In 1963 OKB-155 completed the advanced development project and handed over the project documents to the Gor'kiy aircraft factory, enabling the latter to complete the manufacturing documents. The Ye-7R prototype was built in Gor'kiy by converting a stock MiG-21PF interceptor (c/n N76210825). The aircraft was refitted with an R11F2S-300 engine featuring air bleed valves and equipped with blown flaps; the brake parachute was relocated from the ventral bay to a housing at the base of the rudder and certain aircraft systems were altered to permit installation of new mission equipment and avionics. Outwardly the Ye-7R was almost identical to the early-production MiG-21PFS with the forward-hinged canopy and narrow-chord tail, except for the addition of small cigar-shaped fairings at the wingtips housing ECM equipment. The interchangeable mission equipment pods were carried on a streamlined pylon on the centreline; the pods were developed by the Gor'kiy aircraft factory's own design office. Since the centreline pylon could no longer be used for carrying a drop tank, the number of wing hardpoints was increased from two to four; the outer (new) wing pylons were 'wet', permitting carriage of two 490-litre (107.8 Imp gal) drop tanks instead of one. The inner wing pylons could carry two R-3S or RS-2-US AAMs, two FFAR pods or two bombs of 50-250 kg (110-551 lb) calibre.

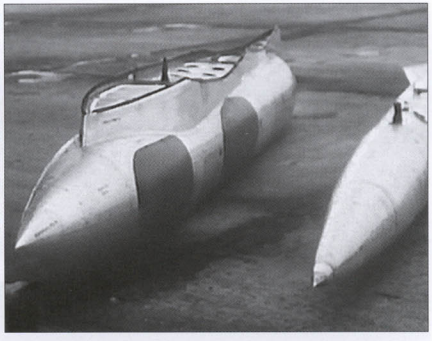
In this configuration the Ye-7R entered flight testing. The manufacturer's tests revealed a serious flaw: even with two drop tanks, the recon-naissance version's combat radius fell short of the requirements. A less serious shortcoming was that the pitot boom was mounted dorsally on the centreline, impairing the pilot's down-ward view over the nose. The same criticism applied to the Su-7B fighter-bomber, which was undergoing tests at the time.

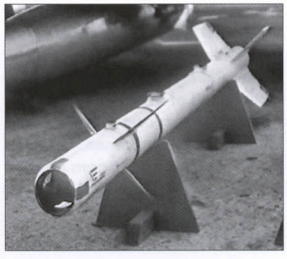
Therefore the Ye-7R underwent a series of modifications. To improve the pilot's field of view the pitot boom was offset to port; this feature had been first tried on the Ye-6U trainer prototype (the MiG-21U – see Chapter 5). The dielectric insert at the top of the fin was reshaped, as it enclosed a different set of antennas.

Coded '78 Red', one of the reconnaissance version's prototypes was tested with a full set of

▲►
One more Ye-7R prototype, '28 Red' (again a converted MiG-21PFS), with the interchangeable mission equipment pods, drop tanks and assorted weapons. Not all of the weapons were compatible with the MiG-21R and were arrayed for show purposes only. Note that, unlike the examples on the opposite page, '28 Red' has the new PVD-7 pitot boom offset to starboard with pitch/yaw transducer vanes.







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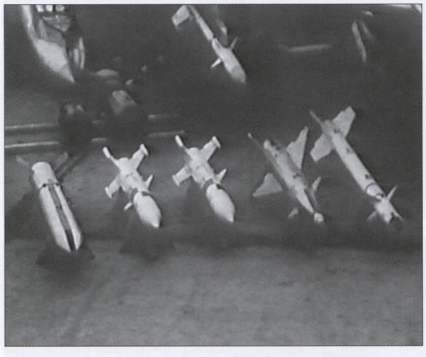
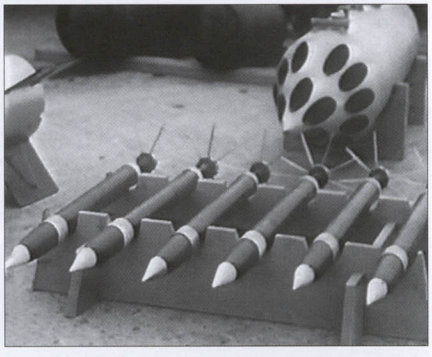
Left to right: the R-3R semi-active radar-homing AAM (which the MiG-21R could not carry), the Type R ELINT pod, and the R-3S IR-homing AAM.





◄◄
Left to right: the S-24 unguided rocket, an unidentified air-to-surface missile, and the RS-2-US and R-3S AAM.

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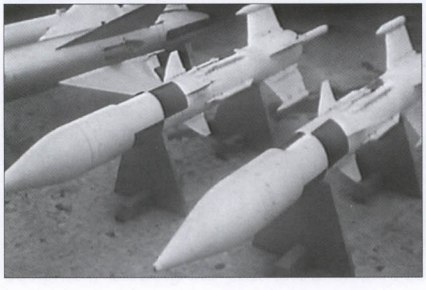
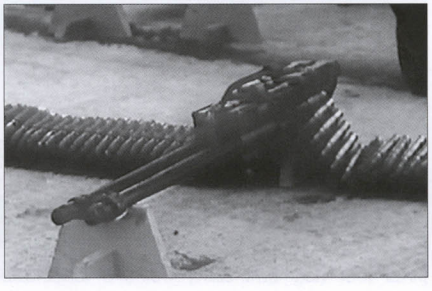
A UB-16-57UMP rocket pod and S-5 FFARs.





Left to right: the unidentified ASM, the GSh-23L cannon, and the OFAB-100M HE/fragmentation bomb.
▼

All photos Yefim Gordon archive

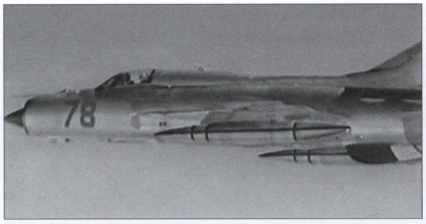
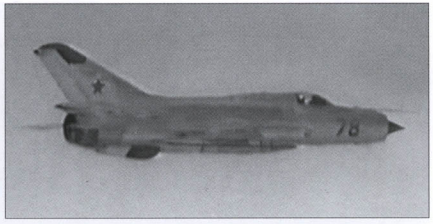
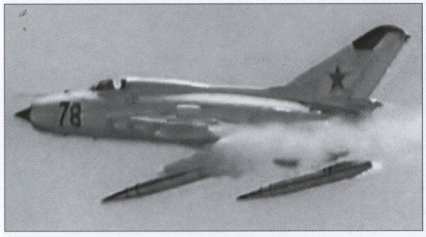
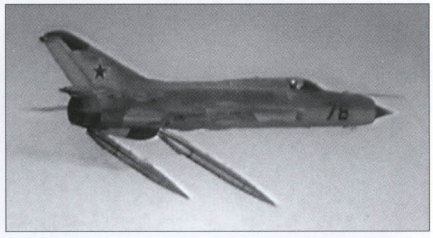
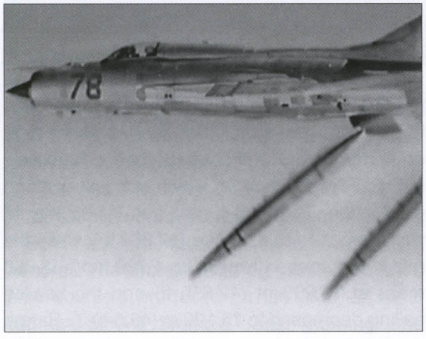
mission equipment. The test programme included not only performance testing and handling checks but also assessment of the aircraft's equipment, primarily the reconnaissance equipment; drop tank separation tests were also performed. Other Ye-7R prototypes included '20 Red', '28 Red' – all based on the early narrow-tailed MiG-21PFS.

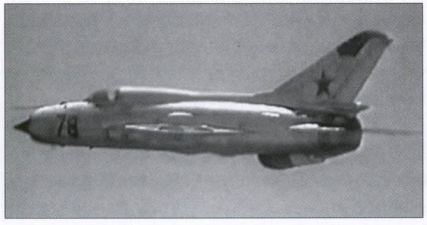
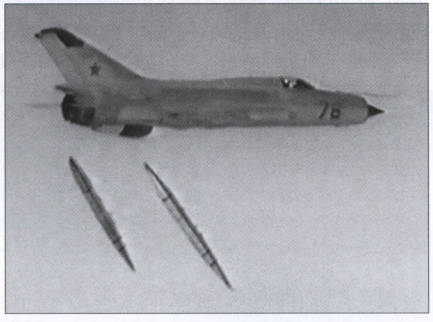
Three versions of the reconnaissance pod were developed for the Ye-7R. The Type D pod (the D stood for *dnev**na**ya* ***fot**orazved**ka*** – daylight PHOTINT) featured a tape recorder for capturing relevant air-to-ground radio communications, two oblique AFA-39 cameras, four AFA-39 cameras for vertical photography and an AFA-5 slit camera. The Type N pod was intended

▲►

'78 Red', one more Ye-7R prototype, carrying a Type R pod, two drop tanks and two R-3S AAMs. Again, the aircraft retaind the one-piece canopy, small saddle tank and narrow-chord tail of the MiG-21PFS, but the fin incorporates a dielectric cap housing antennas. Note the offset pitot boom and the wingtip-mounted ESM fairings.

All photos RSK MiG

◄ **Ye-7R '78 Red' was used for drop tank jettison tests, among other things. Note that the drop tanks have photo calibration markings applied.**

All photos Yefim Gordon archive

for night PHOTINT (hence the N for *noch**na**ya* ***foto**raz**ved**ka*), accommodating an NAFA-47 camera (*noch**noy** **a**ero**foto**appa**raht*** – night operations aerial camera) and 188 illumination flares; these produced a mighty flash after falling a short distance from the aircraft, automatically triggering the camera shutter. The camera had a lens with a high aperture ratio and was loaded with highly sensitive film. Finally, the Type R pod was optimised for ELINT (hence the R for ***rah**dio-tekh**nich**eskaya raz**ved**ka*), housing Romb-4A and Romb-4B (Rhombus, or Diamond) ELINT packs plus an AFA-39 camera for documenting the location.

The aircraft also featured VHF voice link equipment allowing the pilot to transmit voice information over long distances in real time. Air sampling equipment for radiation reconnaissance (RINT) could also be fitted if necessary.

Ye-7R '78 Red' was officially submitted for State acceptance trials on 31st December 1964. By then the aircraft had been further modified. The designers found a simple solution to the range problem – the rear part of the fuselage spine was enlarged to accommodate an additional 340-litre (74.8 Imp gal) fuel tank,

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▶ **Pictured beside MiG-21R '18 Red' are GK NII VVS test pilots (left to right) A. S. Devochkin, Vasiliy S. Kotlov, S. Medvedev, Pyotr F. Kabrelyov, Eduard I. Knyazev, Andrey A. Manucharov, Stepan A. Mikoyan and M. I. Bobrovitskiy. These airmen tested all of the Soviet fighters developed in 1955-1975.**

creating an even upper fuselage contour from canopy to fin. The total internal fuel capacity was thereby increased to 2,800 litres (616 Imp gal) at the expense of only a negligible increase in cross-section area and without the need to sacrifice anything in terms of equipment. To be sure, the weight of the extra fuel and hence the increase in the all-up weight caused a certain deterioration of performance (with the exception of range), but not so much as to dissatisfy the military.

Two more Ye-7R prototypes were converted from production MiG-21PFS interceptors(c/ns 940724 and 940735). Unlike the first prototype, these aircraft had the new sideways-opening two-piece canopy, the KM-1 ejection seat and the new large vertical tail; their systems and equipment were entirely patterned on the new MiG-21PFM interceptor, which was just entering production. The final prototypes' all-up weight was increased to 8,100 kg (17,860 lb), while the maximum speed dropped to 1,700 km/h (1,056 mph) at 13,000 m (42,650 ft) and the service ceiling decreased to 15,100 m (49,540 ft). Range on internal fuel was 1,130 km (702 miles), increasing to 1,600 km (994 miles) with external tanks. In this guise the reconnaissance version was recommended for production and Soviet Air Force service.

The same aircraft with Stepan A. Mikoyan in full flying attire. ▼

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MiG-21R production tactical reconnaissance aircraft (Ye-7R, *izdeliye* 94R, *izdeliye* 03, *Fishbed-H*)

In production form (with the new tail, new canopy and new spine) the Ye-7R bore the service designation MiG-21R. In OKB-155 documents the aircraft was designated *izdeliye* 94R – logically enough, as it was effectively the reconnaissance version of the MiG-21PFM (*izdeliye* 94). However, to confuse the outsider the Gor'kiy aircraft factory and the Air Force initially used a different product code – *izdeliye* 03. Production began in 1965, continuing until 1971 for the needs of the Soviet Air Force and foreign customers alike. The first production MiG-21R (c/n 030101 – that is, *izdeliye* 03, Batch 01, 01st aircraft in the batch) was rolled out in early 1966.

Four construction number systems were apparently used for this version. In addition to the system described above, some MiG-21Rs

had c/ns in the alphanumeric system based on the code word *samo**lyot**chik* and using the same product code (*izdeliye* 03). For example, a Soviet Air Force MiG-21R coded '30 Red' is c/n 030AT22, which equals f/n 1622. Many export examples have eight-digit c/ns. Thus, Bulgarian Air Force '326 White' is c/n 94R01716 – that is,. *izdeliye* 94R, Batch 17, 16th aircraft in the batch. The zero after the product code is sometimes omitted. Finally, some export examples have nine-digit c/ns; for example, Polish Air Force '1273 Red' is c/n 94R021273. The final five digits do not signify *anything at all*; the idea is to conceal the batch number and number of aircraft in the batch. The first two digits of these 'famous last five', as they are often called, change independently from the final three.

The production MiG-21R could be used in the reconnaissance and interceptor roles. In the former case it could carry any of four alternative mission pods – the abovementioned Type D daylight PHOTINT pod, the Type N night PHOTINT pod, the Type R general-purpose ELINT pod and the Type T pod housing a TV reconnaissance system.

The MiG-21R was one of the Soviet Air Force's first reconnaissance aircraft to make use of ELINT equipment in addition to conventional cameras. The aircraft was progressively updated in the course of production; it had an RP-21 radar and an SPO-3 Sirena-3 radar homing and warning system (*sis**tem**a preduprezh**den**iya ob obloo**chen**ii* – RHAWS). As in the case of the MiG-21PFM, the factory took the 'one step at a time' approach with the MiG-21R: the first production batches still had a centrally mounted pitot boom (this departure from the project documents was meant to facilitate production entry). Another characteristic feature of early-production MiG-21Rs was the small dielectric insert in the fuselage spine just ahead of the fin leading edge. Like all variants of *izdeliye* 94, the MiG-21R initially had the R11F2S-300 turbojet; late examples were powered by the R13-300 engine. In the course of production the MiG-21R gained a TS-27AMSh rear view periscope on the hinged portion of the cockpit canopy; previously manufactured examples were retrofitted with the periscope in service. Early MiG-21Rs left the factory with the old KAP-1 and KAP-2 bank-only autopilots because the intended AP-155 three-channel autopilot was not yet in production; only later did this become a standard fit.

Like the prototypes, production MiG-21Rs could be armed with two RS-2-US beam-riding AAMs or R-3S short-range IR-homing AAMs in the counter-air role. In the strike role the aircraft carried two 16-round UB-16-57UM or 32-round UB-32 rocket pods with 57-mm (2.24-in) FFARs, or two 240-mm (9.44-in) S-24 heavy unguided rockets, or two bombs of up to 500 kg (1,102 lb) calibre on the inboard pylons. The latter were often removed when no weapons were carried, reducing drag and thereby slightly increasing the aircraft's range and endurance.

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◄
M. I. Bobrovitskiy poses with the same MiG-21R.

When the production MiG-21R was used as an interceptor, the small wingtip pods housing the RHAWS antennas were removed, leaving the dielectric panel on the fuselage spine, and sometimes a small ventral conduit aft of the nose gear unit, as the only recognition features. Since no reconnaissance pod was carried in this case, the special centreline pylon could be replaced by an ordinary 'wet' pylon which allowed the two 490-litre drop tanks under the wings to be augmented by a third drop tank holding 800 litres (176 Imp gal). Unlike the MiG-21PFM, the MiG-21R had no provision for carrying the GP-9 cannon pod. In strike configuration the MiG-21R could carry 100-kg (220-lb) FAB-100, 250-kg (551-lb) FAB-200 or 500-kg FAB-500 HE bombs, but the latter kind was not used together with the 800-litre drop tank.

The reconnaissance version's NATO reporting name was *Fishbed-H*.

It should be noted that the MiG-21R was hampered by many additional limits imposed on flight performance and operational procedures

as compared with the interceptor versions. Some of these limits are listed below.

In exceptional cases and in combat the aircraft could attain a maximum indicated airspeed of 1,300 km/h (807 mph) and a Mach limit of 2.1 without external stores or with two R-3S AAMs, subject to the following conditions:

- the indicated airspeed was limited to 1,300 km/h at altitudes up to 8,000 m (26,250 ft) and 1,200 km/h (745 mph) at altitudes from 8,000 m to 13,000 m (42,650 ft);
- flight at Mach 2.1 was permitted only at altitudes in excess of 13,000 m;
- the aircraft could perform maximum-G manoeuvres only if the remaining fuel was 1,450 litres (319 Imp gal) or less.

Moreover, flight at 1,300 km/h IAS and Mach 2.1 was permitted only on MiG-21Rs powered by Moscow-built R11F2S-300 engines from c/n T7622001 onwards and Ufa-built engines manufactured from 1st April 1966 onwards. RS-2-US missiles, unguided rockets and bombs could only be carried on the inboard pylons, while carriage of R-3S AAMs was permitted on either pair of wing pylons. No provision was made for carrying weapons on all four hardpoints at once.

MiG-21R '22 Red' at GNIKI VVS shows off the production-standard even-topped fuselage spine with a dielectric insert and the large tail. The aircraft is in interceptor configuration (only the outer wing pylons are fitted); hence the wingtip ESM pods are missing. Note the centrally mounted pitot. ▼

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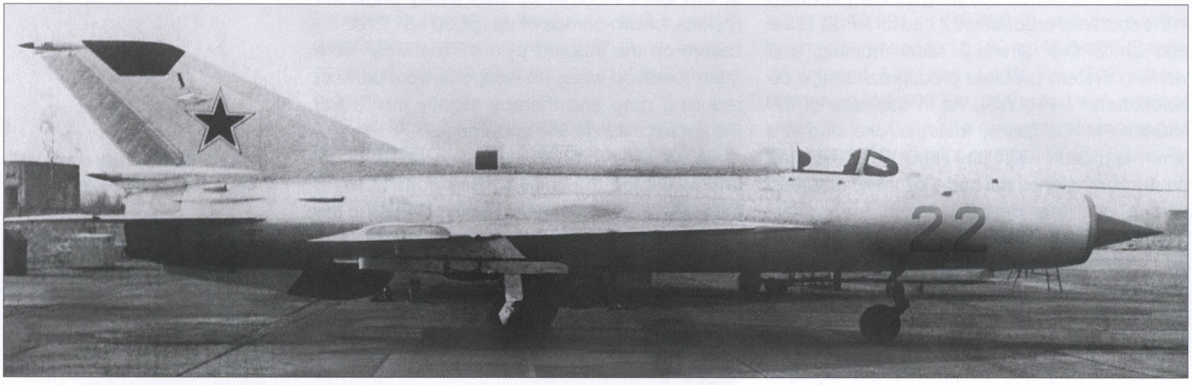
Another MiG-21R ('24 Red') at GNIKI VVS with drop tanks, missile rails and an offset pitot. ▼▼



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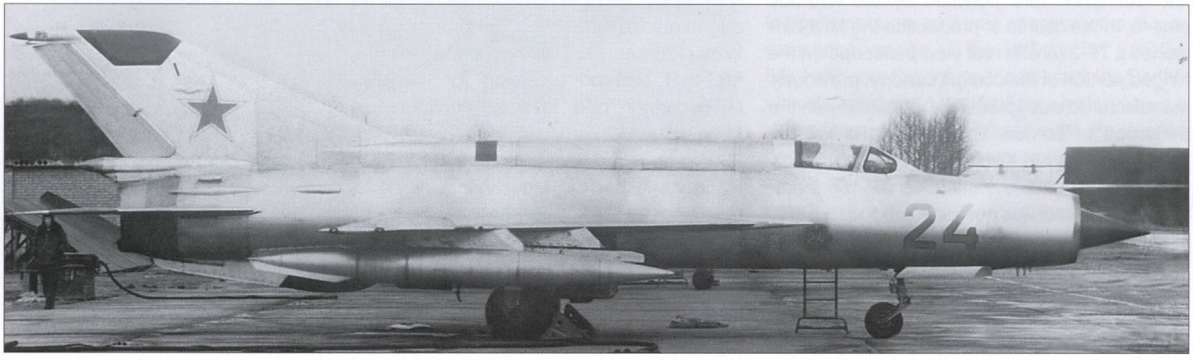

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▲ **A publicity photo of a MiG-21R fitted with a Type R pod and two drop tanks. The aircraft is in tan/green camouflage and wears the 'Excellent Aircraft' maintenance award badge on the nose.**

►▲ **Technicians install a camera in a Type D pod marked D-41. Note the door protecting the forward camera port and the conduit ahead of the pod.**

Early-production Soviet Air Force MiG-21Rs with centrally mounted pitots. '27 Red' is in first-line service, while '303 White' is operated by the Barnaul Military Pilot College (BVVAUL). ▼►

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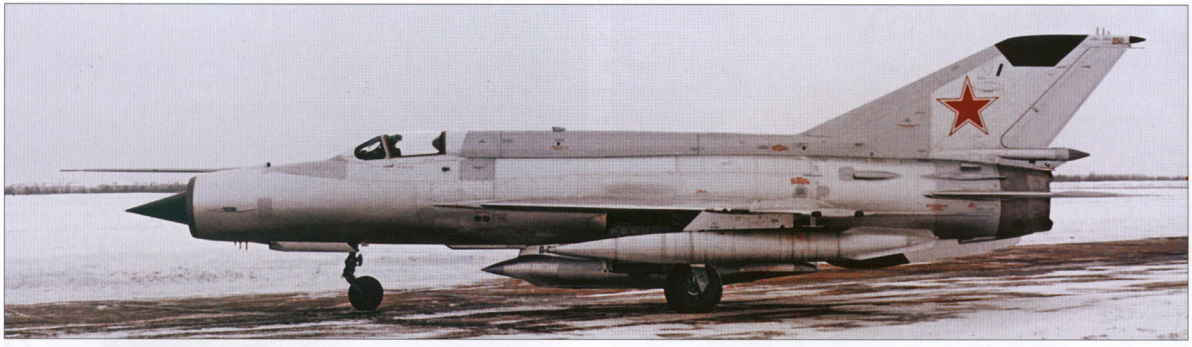
BVVAUL

The MiG-21R was able to take off from paved runways, except tactical airstrips covered with perforated steel planking (PSP), with all take-off weights up to the maximum figure of 9,800 kg (21,605 lb) and all permitted combinations of external stores. When SPRD-99 JATO boosters were fitted, take-off from the abovesaid runways was possible with the following external stores options:

- two R-3S or RS-2-US AAMs;
- two UB-16-57UM FFAR pods;
- two FAB-100 or FAB-250 HE bombs;
- two S-24 heavy unguided rockets;
- a single 490-litre drop tank plus two AAMs, or two FFAR pods, or two FAB-100 bombs;
- a mission equipment pod under the fuselage (with no underwing stores);
- a mission equipment pod plus two AAMs, or two FFAR pods, or two FAB-100/FAB-250 bombs, or two S-24 rockets.

RSK MiG



RSK MiG

▲▲▶ **An uncoded MiG-21R with a Type D pod and two drop tanks. Note the portside AoA sensor and the characteristic pitot boom offset to starboard but lacking pitch/yaw vanes.**

▲ **The front end of the pod with the access panel of the oblique forward camera removed.**

RSK MiG

Take-off from PSP, dirt/grass and hard-packed snow runways was possible with a maximum permitted take-off weight of 8,800 kg (19,400 lb) and the following payload options:

- two R-3S or RS-2-US AAMs;
- two UB-16-57UM FFAR pods;
- two FAB-100 or FAB-250 HE bombs;
- two S-24 heavy unguided rockets;

Operational limits of the MiG-21R

	Without drop tanks				With drop tanks	
					One PTB-490 or PTB-800	
External stores	**no ordnance; w. R-3S AAMs**	**w. RS-2-US AAMs**	**w. UB-16-57UM FFAR pods**	**w. S-24 rockets, bombs or ZB-500 napalm tanks**	**no ordnance; w. R-3S or RS-2-US AAMs; w. FFAR pods**	**w. S-24 rockets, bombs* or ZB-500 napalm tanks**
Indicated airspeed, km/h (mph)	1,100 (683) up to 2,000 m (6,560 ft); 1,200 (745) at 2,000-12,500 m (6,560-41,010 ft)	1,100 (683) up to 5,000 m (16,400 ft); 1,200 (745) at 5,000-12,500 m (16,400-41,010 ft)	1,000 (621) up to 13,500 m (44,290 ft)	1,000 (621) up to 8,500 m (27,890 ft)	1,000 (621) up to 12,000 m (39,370 ft)	1,000 (621) up to 8,500 m (27,890 ft)
Mach limit	2.05 at altitudes above 12,500 m	2.05 at altitudes above 12,500 m	1.8 at altitudes above 13,500 m	1.3 at altitudes above 8,500 m	1.6 at altitudes above 12,000 m	1.3 at altitudes above 8,500 m
G limit	6.0 with more than 1,400 lit. (308 Imp gal) of fuel; 7.0 with less than 1,400 lit. of fuel	6.0 with more than 1,400 lit. (308 Imp gal) of fuel; 7.0 with less than 1,400 lit. of fuel	6.0	6.0 5.0 with FAB-500 bombs or ZB-500 napalm tanks	5.0 with PTB-490 drop tank 4.0 with PTB-800 drop tank;	5.0 with PTB-490 drop tank; 4.0 with PTB-800 drop tank

* FAB-500 bombs are not carried together with the PTB-800 drop tank

• a single 490-litre drop tank plus two AAMs, or two FFAR pods, or two FAB-100 bombs;

• a mission equipment pod plus two AAMs, or two FFAR pods, or two FAB-100/FAB-250 bombs, or two S-24 rockets.

Take-off from dirt airstrips with a bearing strength of 7-10 kg/cm² (100-142 lb/sq in) with the help of JATO boosters was permitted with the following external stores options:

• two R-3S or RS-2-US AAMs;

• two UB-16-57UM FFAR pods;

• two FAB-100 or FAB-250 HE bombs;

• a mission equipment pod under the fuselage (with no underwing stores).

The minimum indicated airspeed with the mission equipment pod and/or underwing stores in place was not to exceed 240-270 km/h (149-167 mph). The maximum permitted flight speed with the landing gear down was 700 km/h (435 mph) IAS, while the brake parachute could be deployed at speeds up to 320 km/h (198 mph). Prolonged flight at Mach 0.85-0.89 was prohibited because the MiG-21R was prone to vibration and suffered from lack of roll stability at these Mach numbers. If the aircraft was carrying a mission equipment pod, two drop tanks and two AAMs or FFAR pods (or three drop tanks plus two AAMs or FFAR pods), it was forbidden to deploy the flaps and landing gear and perform a landing if the remaining fuel quantity was 700-1,100 litres (154-242 Imp gal) or more. With RS-2-US missiles manufactured before 1965 the MiG-21R could operate only from paved runways, since these AAMs lacked the structural reinforcements of later examples allowing operations from dirt or snow airstrips.

Take-off with JATO boosters from paved runways (except PSP airstrips) was possible with a maximum take-off weight of 9,100 kg (20,060 lb); on PSP and unpaved airstrips the TOW with boosters was limited to 8,800 kg (19,400 lb). In an emergency it was permitted to exceed the landing weight limit of 6,800 kg (14,990 lb), but the landing weight was not to exceed 7,300 kg (16,090 lb). These weight limits applied to the following flight conditions:

a) with or without a mission equipment pod, with the drop tanks and all other external stores (except the pod) being jettisoned after take-off;

b) in interceptor or strike configuration (without the mission equipment pod):

• without external stores, or with FAB-100 bombs, UB-16-57UM FFAR pods or AAMs, given that the remaining fuel quantity does not exceed 1,700 litres (374 Imp gal);

• with S-24 rockets, FAB-250 bombs, UB-16-57UM FFAR pods or AAMs, given that the remaining fuel quantity does not exceed 1,4700 litres (308 Imp gal)

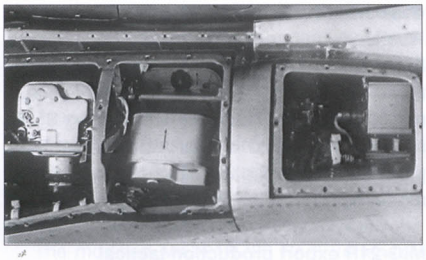
In addition to the regular PHOTINT and ELINT pods, the MiG-21R was test flown with four types of experimental mission equipment pods.

		With mission equipment pod and SPO-3 RHAWS wingtip pods			
Two or three PTB-490s	Two PTB-490s and one PTB-800	Without drop tanks			With two PTB-490s
no ordnance; w. R-3S or RS-2-US AAMs; w. FFAR pods	no ordnance	no ordnance; w. R-3S or RS-2-US AAMs	w. UB-16-57UM FFAR pods	w. S-24 rockets, FAB-250 or FAB-100 bombs	no ordnance; w. R-3S or RS-2-US AAMs; w. FFAR pods
1,000 (621) up to 12,000 m (39,370 ft)	1,000 (621) up to 12,000 m (39,370 ft)	1,100 (683) up to 10,000 m (32,810 ft)	1,000 (621) up to 12,000 m (39,370 ft)	1,000 (621) up to 8,500 m (27,890 ft)	1,000 (621) up to 12,000 m (39,370 ft)
1.6 at altitudes above 12,000 m 5.0	1.6 at altitudes above 12,000 m 4.0	1.6 at altitudes above 12,000 m 6.0	1.6 at altitudes above 12,000 m 6.0	1.3 at altitudes above 8,500 m 6.0	1.6 at altitudes above 12,000 m 6.0

External stores options and take-off weights of the MiG-21R

Option	Port outer pylon (No. 3)	Port inner pylon (No. 1)	Centreline pylon	Starboard inner pylon (No. 2)	Starboard outer pylon (No. 4)	TOW, kg (lb)
a) Reconnaissance/strike configuration						
1	–	–	Reconnaissance pod	–	–	8,180 (18,030)
2	–	R-3S missile	Reconnaissance pod	R-3S missile	–	8,380 (18,470)
3	–	RS-2-US missile	Reconnaissance pod	RS-2-US missile	–	8,380 (18,470)
4	–	UB-16-57UM rocket pod	Reconnaissance pod	UB-16-57UM rocket pod	–	8,420 (18,560)
5	–	S-24 unguided rocket	Reconnaissance pod	S-24 unguided rocket	–	8,680 (19,135)
6	–	FAB-100 HE bomb	Reconnaissance pod	FAB-100 HE bomb	–	8,380 (18,470)
7	–	FAB-250 HE bomb	Reconnaissance pod	FAB-250 HE bomb	–	8,680 (19,135)
8	PTB-490 drop tank	–	Reconnaissance pod	–	PTB-490 drop tank	9,130 (20,130)
9	PTB-490 drop tank	R-3S missile	Reconnaissance pod	R-3S missile	PTB-490 drop tank	9,330 (20,570)
10	PTB-490 drop tank	RS-2-US missile	Reconnaissance pod	RS-2-US missile	PTB-490 drop tank	9,330 (20,570)
11	PTB-490 drop tank	UB-16-57UM	Reconnaissance pod	UB-16-57UM	PTB-490 drop tank	9,370 (20,660)
b) interceptor/strike configuration						
1	–	–	–	–	–	7,860 (17,330)
2	–	R-3S missile	–	R-3S missile	–	8,060 (17,770)
3	–	RS-2-US missile	–	RS-2-US missile	–	8,060 (17,770)
4	–	UB-16-57UM rocket pod	–	UB-16-57UM rocket pod	–	8,100 (17,860)
5	–	FAB-100 HE bomb	–	FAB-100 HE bomb	–	8,060 (17,770)
6	–	FAB-250 HE bomb	–	FAB-250 HE bomb	–	8,360 (18,430)
7	–	FAB-500 HE bomb	–	FAB-500 HE bomb	–	8,860 (19,530)
8	–	S-24 unguided rocket	–	S-24 unguided rocket	–	8,360 (18,430)
9	–	ZB-500 napalm tank	–	ZB-500 napalm tank	–	8,610 (18,980)
10	–	–	PTB-490 drop tank	–	–	8,340 (18,390)
11	–	R-3S missile	PTB-490 drop tank	R-3S missile	–	8,540 (18,830)
12	–	RS-2-US missile	PTB-490 drop tank	RS-2-US missile	–	8,540 (18,830)
13	–	UB-16-57UM rocket pod	PTB-490 drop tank	UB-16-57UM rocket pod	–	8,580 (18,915)
14	–	FAB-100 HE bomb	PTB-490 drop tank	FAB-100 HE bomb	–	8,540 (18,830)
15	–	FAB-250 HE bomb	PTB-490 drop tank	FAB-250 HE bomb	–	8,840 (19,490)
16	–	FAB-500 HE bomb	PTB-490 drop tank	FAB-500 HE bomb	–	9,340 (20,590)
17	–	S-24 unguided rocket	PTB-490 drop tank	S-24 unguided rocket	–	8,840 (19,490)
18	–	ZB-500 napalm tank	PTB-490 drop tank	ZB-500 napalm tank	–	9,080 (20,020)
19	–	–	PTB-800 drop tank	–	–	8,580 (18,915)
20	–	R-3S missile	PTB-800 drop tank	R-3S missile	–	8,780 (19,360)
21	–	RS-2-US missile	PTB-800 drop tank	RS-2-US missile	–	8,780 (19,360)
22	–	UB-16-57UM rocket pod	PTB-800 drop tank	UB-16-57UM rocket pod	–	8,820 (19,440)
23	–	FAB-100 HE bomb	PTB-800 drop tank	FAB-100 HE bomb	–	8,780 (19,360)
24	–	FAB-250 HE bomb	PTB-800 drop tank	FAB-250 HE bomb	–	9,080 (20,020)
25	–	S-24 unguided rocket	PTB-800 drop tank	S-24 unguided rocket	–	9,080 (20,020)
26	–	ZB-500 napalm tank	PTB-800 drop tank	ZB-500 napalm tank	–	9,320 (20,550)
27	PTB-490 drop tank	R-3S missile	–	R-3S missile	PTB-490 drop tank	9,110 (20,080)
28	PTB-490 drop tank	RS-2-US missile	–	RS-2-US missile	PTB-490 drop tank	9,110 (20,080)
29	PTB-490 drop tank	UB-16-57UM rocket pod	–	UB-16-57UM rocket pod	PTB-490 drop tank	9,150 (20,170)
30	PTB-490 drop tank	FAB-100 HE bomb	–	FAB-100 HE bomb	PTB-490 drop tank	9,110 (20,080)
31	PTB-490 drop tank	–	PTB-490 drop tank	–	PTB-490 drop tank	9,290 (20,480)
32	PTB-490 drop tank	R-3S missile	PTB-490 drop tank	R-3S missile	PTB-490 drop tank	9,490 (20,920)
33	PTB-490 drop tank	RS-2-US missile	PTB-490 drop tank	RS-2-US missile	PTB-490 drop tank	9,490 (20,920)
34	PTB-490 drop tank	UB-16-57UM rocket pod	PTB-490 drop tank	UB-16-57UM rocket pod	PTB-490 drop tank	9,530 (21,010)
35	PTB-490 drop tank	–	PTB-800 drop tank	–	PTB-490 drop tank	9,540 (21,030)

* For all options, the TOW is given, assuming the specific gravity of the fuel is 0.83 g/cm³. If OFAB-100 HE/frag bombs are used instead of FAB-100s, the TOW is increased by 25 kg (55 lb) per bomb.



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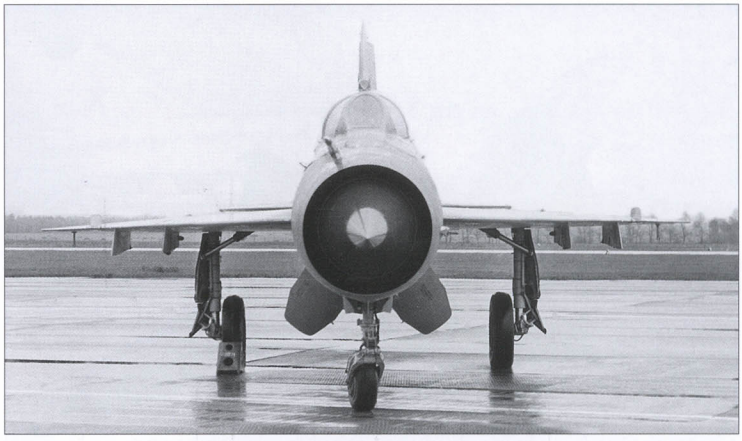
Vertical and oblique cameras in the Type D pod.



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Camouflaged MiG-21Rs '83 White outline', '135 White outline' and '309 White' with the TS-27AMSh rear view periscope on the canopy.
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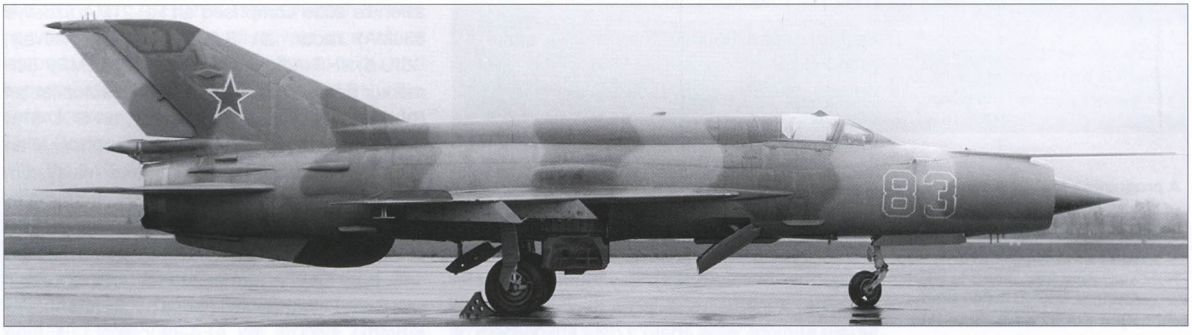

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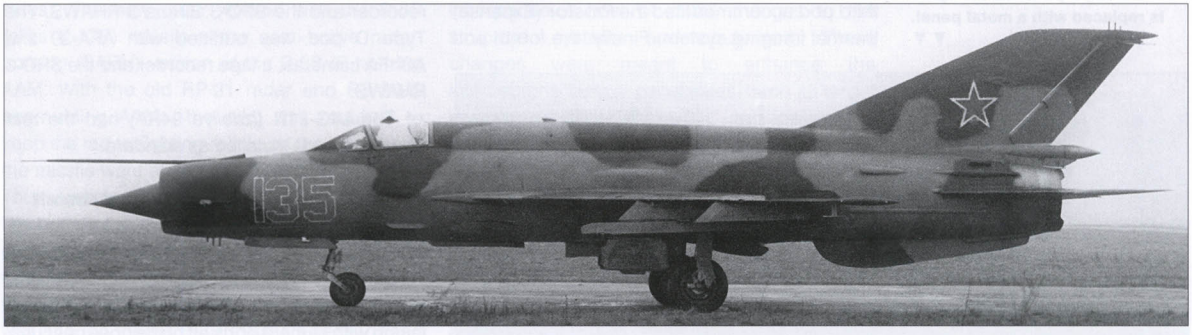

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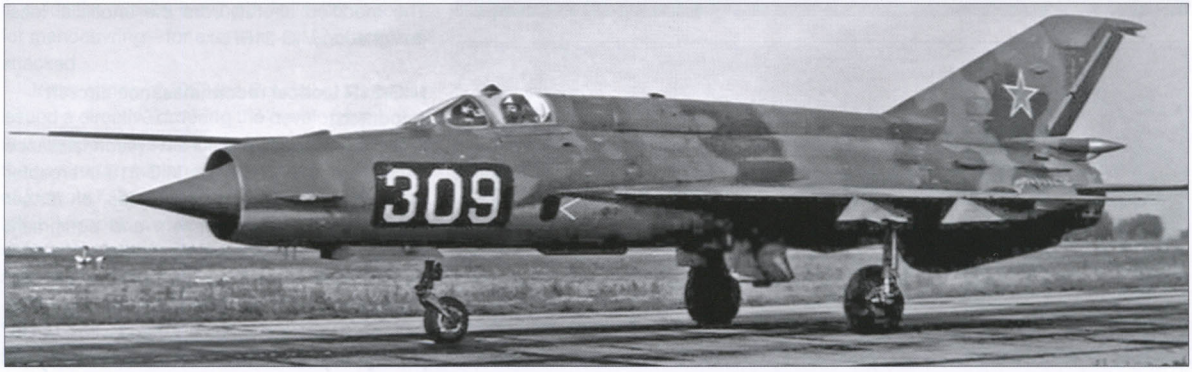

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This view of MiG-21R '22 Red' shows the underside of the Type D camera pod and the wingtip ESM fairings.

A production MiG-21R coded '39 White outline' during an open doors day at a Russian airbase.
▼

Another MiG-21R ('49 White outline') at Kubinka AB. Note that the dielectric panel on the spine is replaced with a metal panel.
▼▼

One of these housed the TARK-1 aerial TV reconnaissance system (*televizi**on**nyy aviatsi-**on**nyy raz**ved**yvatel'nyy **kom**pleks*) with TV cameras and a data link transmitter for sending the imagery to command, control, communications and intelligence (C^3I) centres in real time. The system was tested concurrently on a modified Yak-28R *Brewer-D* twin-turbojet supersonic reconnaissance aircraft. Another pod housed a Shpil' (Spire) day/night reconnaissance system using a laser to illuminate the terrain at night, plus again a data link system. A third pod accommodated the *Pro**stor*** (Expanse) thermal imaging system. Finally, the fourth pod was outfitted with special low-altitude cameras of Western origin obtained from Egypt. It was intended for ultra-low-level operations at altitudes right down to 10 m (33 ft), a technique mastered by the Arab pilots; the existing Soviet aerial cameras did not provide the required picture quality during vertical photography in this mode, being designed for higher altitudes.

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MiG-21R export production tactical reconnaissance aircraft (*izdeliye* 94RA, *Fishbed-H*)

Since it was by then customary to designate Mikoyan fighters intended for 'friendly nations' and fitted with a slightly different avionics suite as 'version A', the export version of the MiG-21R received the product code '*izdeliye* 94RA'. Its avionics suite comprised an RP-21MA (*izdeliye* 830MA) radar, an R-802V (or, alternatively, RSIU-5) VHF radio, an ARK-10 ADF, an MRP-56P marker beacon receiver, an AP-155 autopilot, an RV-UM low-range radio altimeter, an SOD-57M decimetre-waveband ATC transponder, an ARL-S (aka Lazoor') GCI command link system and an SRZO-2 Khrom-Nikel' IFF interrogator/transponder. The aircraft was delivered with two of the MiG-21R's reconnaissance pods – Type R and Type D; the former model housed SRS-6 and SRS-7 signals intelligence packs (***stahn**tsiya raz**ved**ki **svya**zi*), an AFA-39 camera, a tape recorder and the SPO-3 Sirena 3 RHAWS. The Type D pod was outfitted with AFA-39 and AShFA cameras, a tape recorder and the SRO-3 RHAWS.

The MiG-21R (*izdeliye* 94RA) had the rear view periscope installed as standard.

MiG-21RF tactical reconnaissance aircraft (*izdeliye* 94RA, *Fishbed-H*)

The MiG-21Rs delivered to the Egyptian Air Force received a local upgrade: the cameras were permanently installed in a shallow canoe fairing with camera ports aft of the nose gear unit. The modified aircraft bore the unofficial local designation MiG-21RF.

MiG-21R tactical reconnaissance aircraft (modified)

Since the production MiG-21R reconnaissance aircraft and the production MiG-21S interceptor had a lot in common, the idea of further standardising their armament and equipment cropped up at the OKB. A standard MiG-21R coded '20 Red' was retrofitted with some of the avionics used on the MiG-21S, including the Sapfeer-21 (RP-22) radar, and fitted with a PVD-7 pitot (*pree**yom**nik voz**doosh**novo dav**len**iya* –

pitot) offset to starboard; it had a greater measurement range and carried pitch/yaw transducer vanes. The new radar allowed the aircraft to carry the new R-3R semi-active radar-homing AAMs instead of the outdated RS-2-US beam-riding missiles. Thus, in interceptor configuration the machine had the following weapons options: four R-3S IR-homing AAMs, or four R-3R AAMs, or a mix of both models (two of each type).

The modified MiG-21R '20 Red' underwent trials at GNIKI VVS. For some reason, however, it was considered inexpedient to convert operational MiG-21Rs to this standard.

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▲
MiG-21R '20 Red' was fitted experimentally with the RP-22 radar enabling it to carry R-3R radar-homing AAMs. It is seen here at GNIKI VVS with four inert R-3Rs.

Ye-7S tactical fighter prototype

Once the tests of the new broad-chord vertical tail had been completed, the aforementioned MiG-21PF c/n 76210725 (see Chapter 3) was converted into what was effectively an avionics testbed. The aircraft was fitted with the experimental Sapfeer-21 (Sapphire-21) fire control radar developed by OKB-339 under Chief Designer Fyodor F. Volkov. As compared with the MiG-21PF's standard TsD-30TP radar (alias RP-21), the new radar offered higher performance. While the scan angles remained the same, the maximum detection range for a bomber-type target was 30 km (18.6 miles) and the maximum target tracking range was increased from 10 to 15 km (from 6.2 to 9.3 miles). The new radar worked with the R-3R (alias K-13R) missile – the semi-active radar-homing (SARH) version of the R-3S IR-homing AAM. With the old RP-21 radar and RS-2-US beam-riding AAMs, the pilot was required to keep the radar sighting reticle on the target until the missile went all the way in and scored a hit. This severely limited his manoeuvring capabilities because in the event of a manoeuvre radar contact with the target would be lost and the missile would go ballistic. In contrast, as long as the Sapfeer-21 radar illuminated the target, this was enough for the R-3R missile's seeker head to guide the missile, leaving the pilot some room for manoeuvring – for example, evasive action if attacked.

In the spring of 1962 the Council of Ministers issued a directive ordering the development of a new weapons system based on the MiG-21 with the new radar, setting a development time frame of just over three years. At the same time the MKB Vympel weapons design bureau was ordered to develop the K-13M IR-homing AAM as a longer-range replacement for the R-3S.

Bearing the manufacturer's designation Ye-7S (the S suffix was a reference to the Sapfeer-21 radar), the modified aircraft entered manufacturer's flight test on 21st September 1963. On 13th May 1964 it was submitted for joint State acceptance trials. However, as mentioned earlier, the Ye-7S prototype (c/n N76210725) was no more than an avionics testbed, being fitted only with the new radar, whereas production-standard Ye-7S interceptors were to incorporate a host of other changes to the structure, systems and equipment. These changes were meant to enhance the interceptor's tactical capabilities, such as target interception capability in IMC and low-altitude performance. These changes were meant to enhance the interceptor's tactical potential, such as target interception capability in poor weather and low-altitude operating capability. Therefore the Gor'kiy aircraft factory No. 21 was tasked with completing two further interceptors with the Sapfeer-21 radar in production configuration and submitting them for State acceptance trials jointly with the Mikoyan OKB.

Another view of the same aircraft; note the lack of the rear view periscope.
▼

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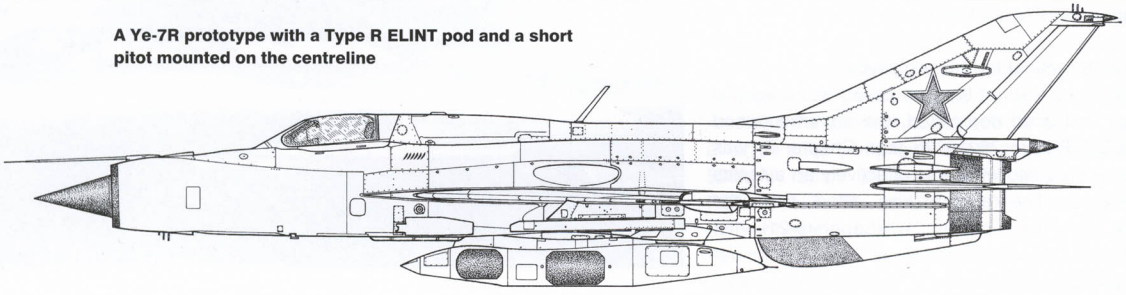
MiG-21S tactical fighter (Ye-7S, *izdeliye* 95, *Fishbed-J*)

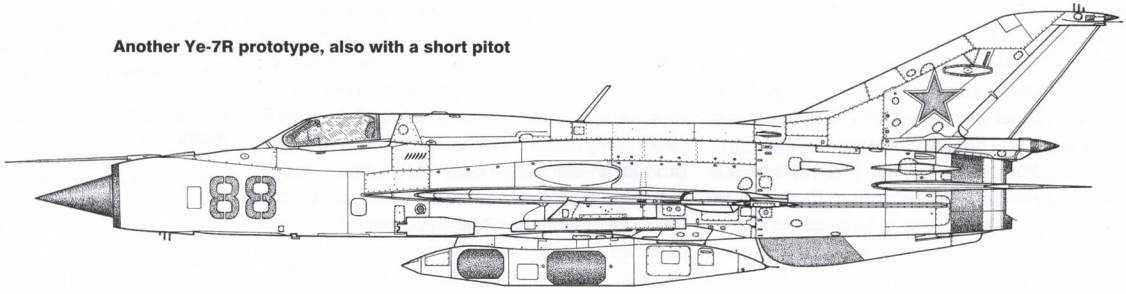
In 1964 the Gor'kiy aircraft factory converted two standard MiG-21PFMs into the prototypes of the production-standard Ye-7S; in this guise the fighter received the service designation MiG-21S and the product code '*izdeliye* 95'. As already mentioned, the extra fuel tankage housed in the redesigned fuselage spine of the MiG-21R reconnaissance aircraft gave an increase in range without causing an unacceptable deterioration of the other performance parameters. Therefore the designers chose to incorporate this feature on the interceptor as well in order to increase the combat radius.

The new fighter's Sapfeer-21 radar (known as the S-21 or RP-22 in production form) worked in conjunction with an ASP-PF-21 computing sight that had been put through its paces on the Ye-7M prototype (see below). This compact sight featuring manual target range input allowed unguided rockets to be fired accurately

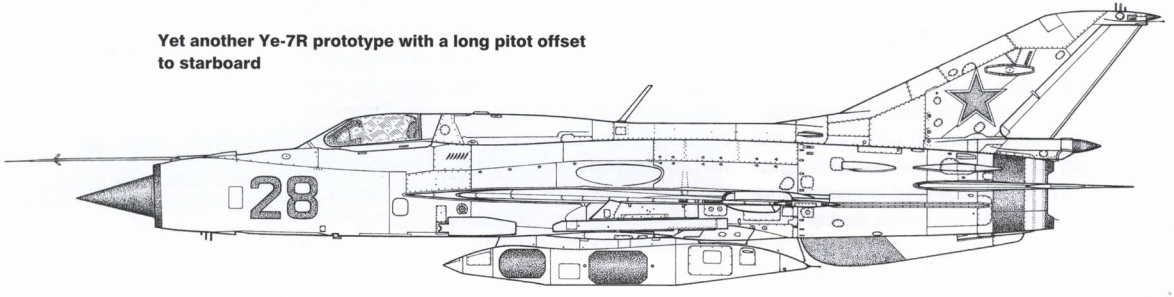
A Ye-7R prototype with a Type R ELINT pod and a short pitot mounted on the centreline



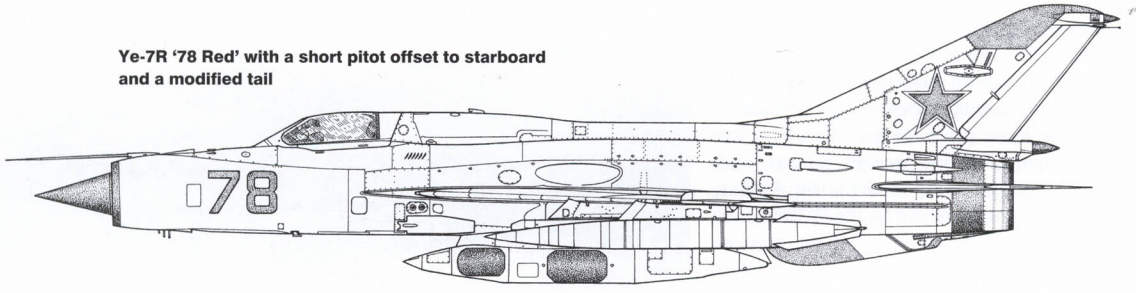
Another Ye-7R prototype, also with a short pitot



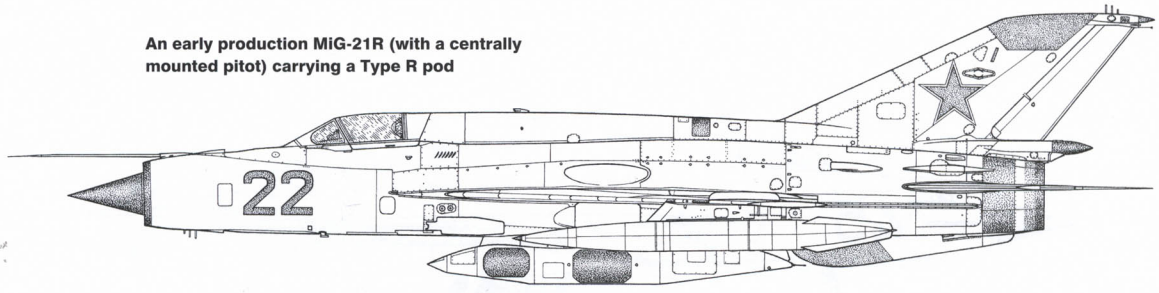
Yet another Ye-7R prototype with a long pitot offset to starboard



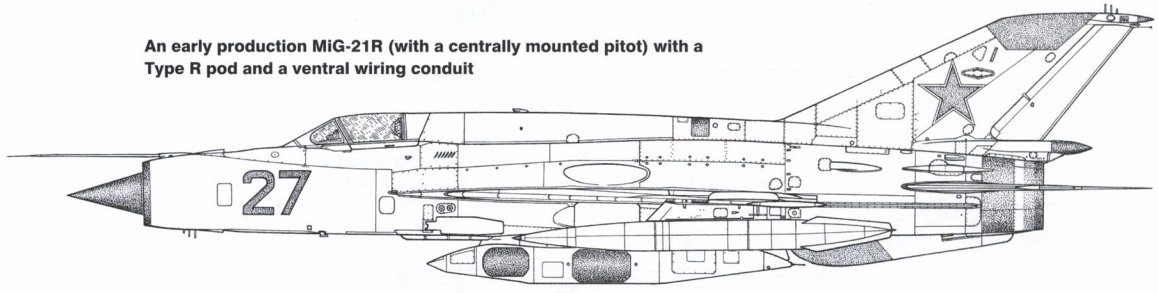
Ye-7R '78 Red' with a short pitot offset to starboard and a modified tail



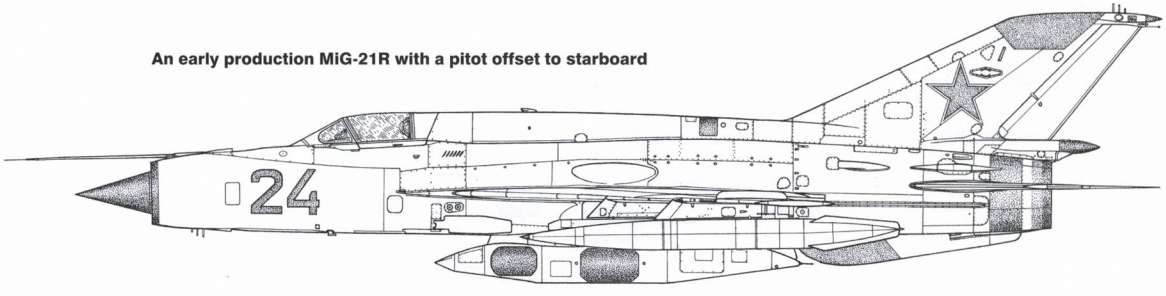
An early production MiG-21R (with a centrally mounted pitot) carrying a Type R pod



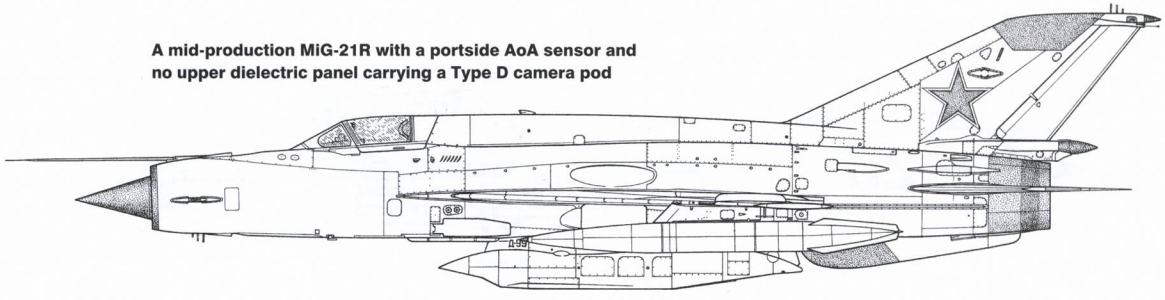
An early production MiG-21R (with a centrally mounted pitot) with a Type R pod and a ventral wiring conduit



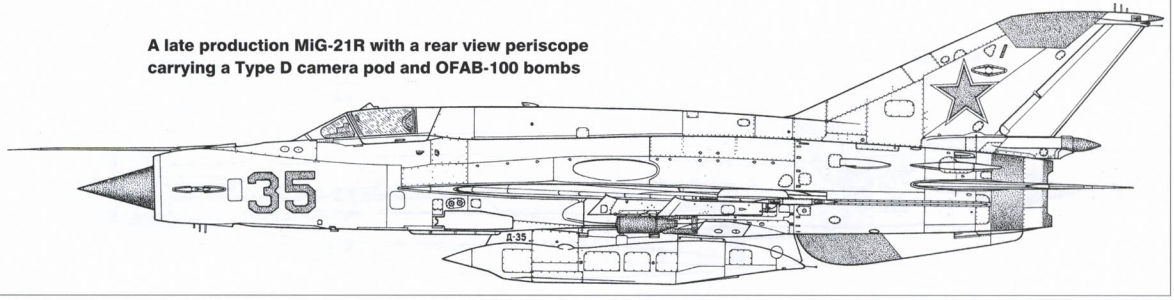
An early production MiG-21R with a pitot offset to starboard

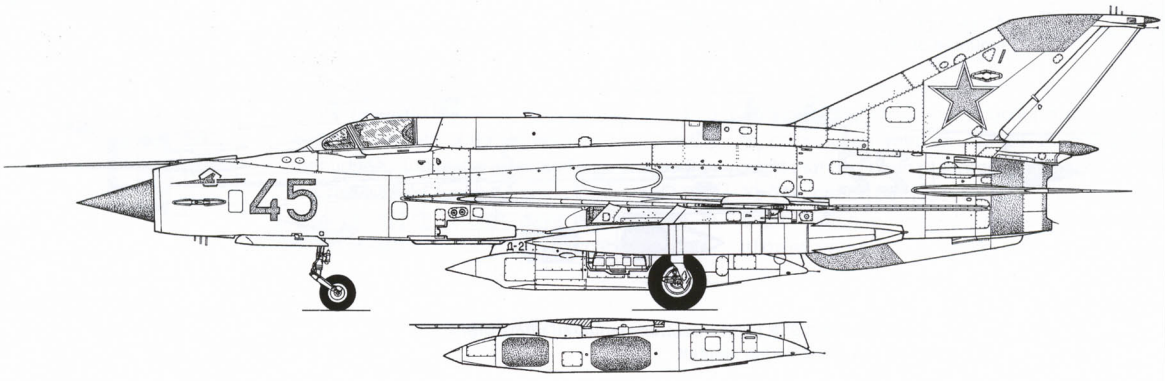


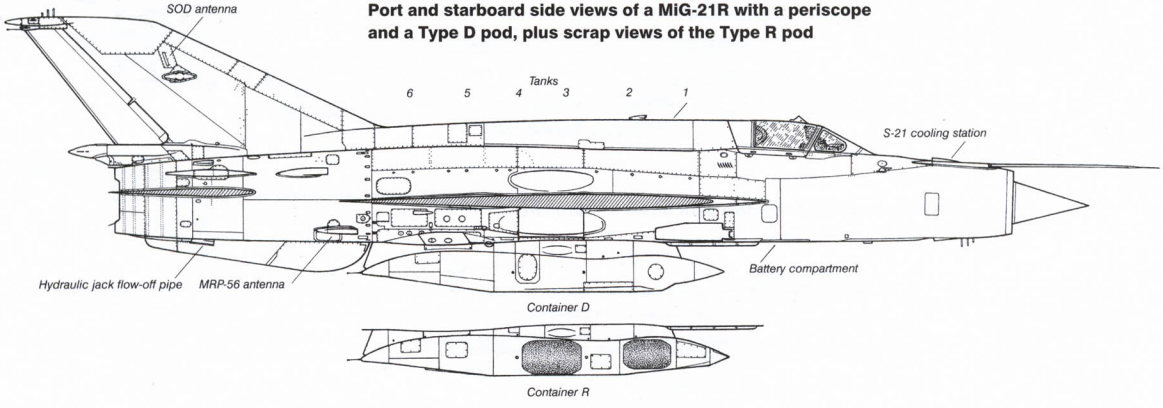
A mid-production MiG-21R with a portside AoA sensor and no upper dielectric panel carrying a Type D camera pod



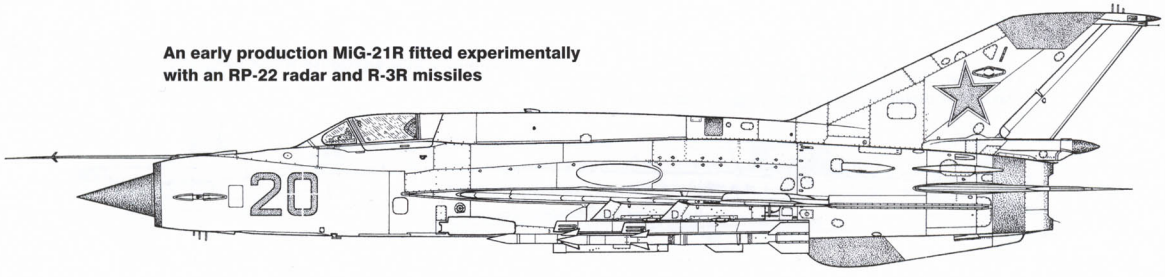
A late production MiG-21R with a rear view periscope carrying a Type D camera pod and OFAB-100 bombs



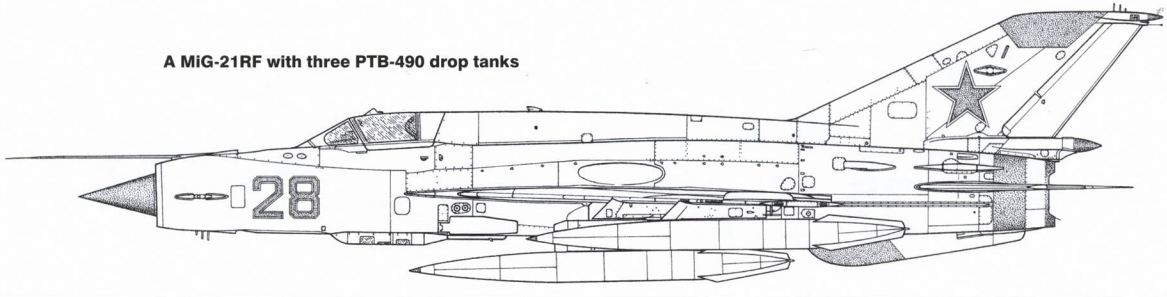




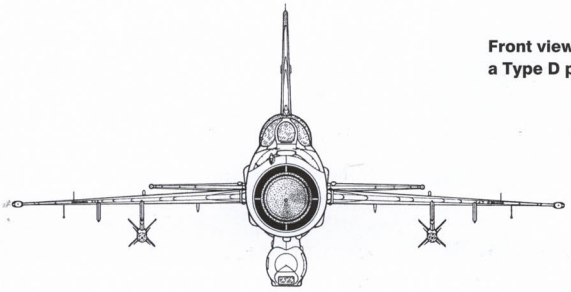
Port and starboard side views of a MiG-21R with a periscope and a Type D pod, plus scrap views of the Type R pod



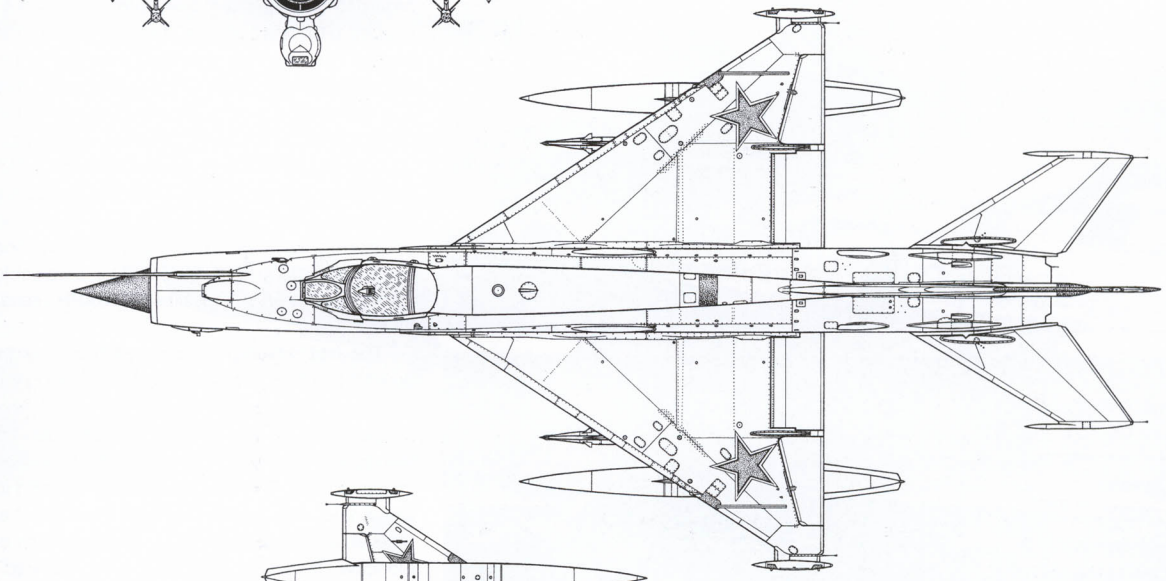
An early production MiG-21R fitted experimentally with an RP-22 radar and R-3R missiles

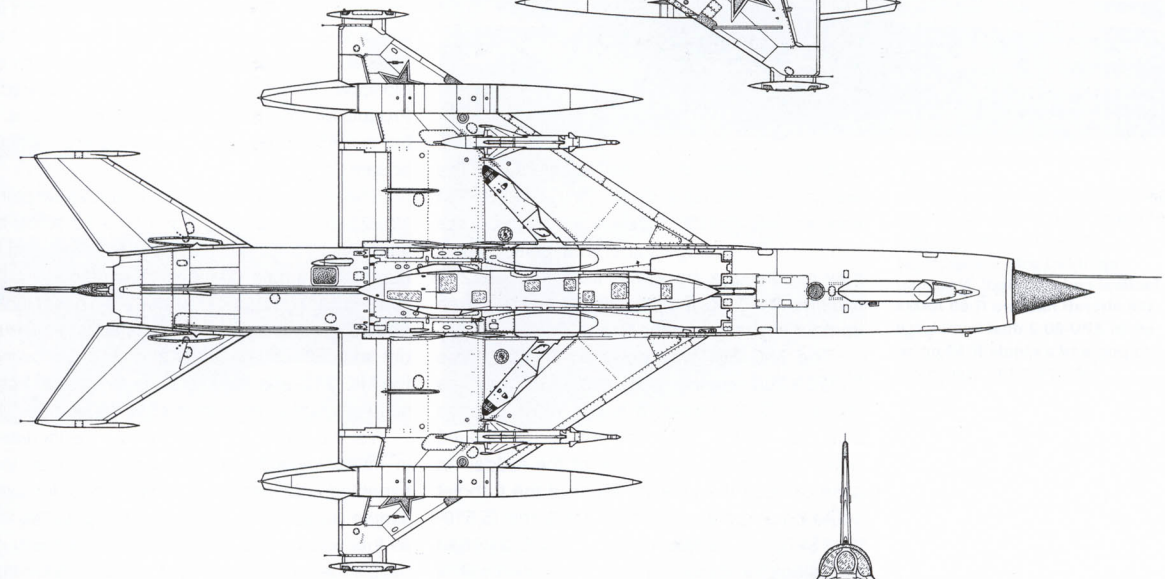


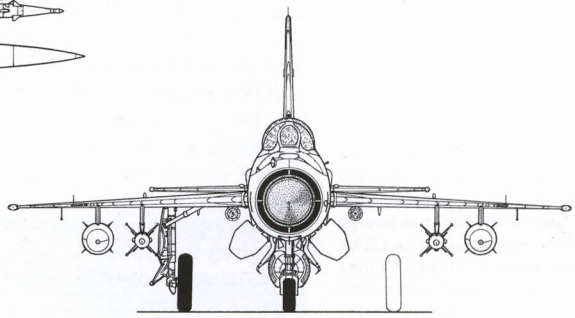
A MiG-21RF with three PTB-490 drop tanks



Front view of a late MiG-21R with a periscope, a Type D pod and R-3S AAMs







Three views of a late MiG-21R with a Type D pod, two drop tanks and two RS-2-US AAMs

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▶ **The second prototype MiG-21S, '92 Red', seen during trials at GNIKI VVS with four inert R-3Rs.**

Upon completion of the tests MiG-21S '92 Red' was put on display at the Soviet (now Central Russian) Air Force Museum in Monino. ▼

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▲ **Same aircraft, same location, but at a later date. In due course the MiG-21S at Monino was repainted with the spurious tactical code '93 Red'. Note that the aircraft has two R-60 AAMs on an APU-60-2 dual launch rail to port and a single R-60 on an APU-60-1 to starboard.**

at ground targets and aerial targets alike. The standard saddle tank of the MiG-21PFS/PFM (*izdeliye* 94), which tapered off towards the middle of the fuselage spine, was replaced by a new saddle tank borrowed from the MiG-21R (*izdeliye* 94R) so that the spine had an even contour all the way to the fin.

The MiG-21S was powered by the same R11F2S-300 engine and equipped with the standard BLC system. It had a KM-1 ejection seat, an AP-155 autopilot and a PT-5282-62 brake parachute at the base of the rudder. In case of need the take-off thrust of the turbojet could be augmented by two 2,500-kgp (5,510-lbst) SPRD-99 JATO boosters. The MiG-21S had provisions for fitting a GP-9 cannon pod with a GSh-23 cannon and 200 rounds. The AP-155 autopilot replacing the old KAP-2 bank-only autopilot not only provided autostabilisation around all three axes but also had a 'panic button' feature, allowing the pilot to return the machine to straight and level flight from any attitude with ensuing stabilisation of heading and altitude. The mission avionics were updated by including an improved ARL-S Lazoor'-M GCI command link system and a new SPO-10 RHAWS. The aircraft featured a new PVD-7 main pitot; the air data boom was offset to starboard and carried pitch/yaw transducer vanes. Data from the pitot head were fed to the vertical gyro, while the inputs from the pitch and yaw sensors were fed to the processor of the ASP-PF-21 sight. Oddly, though the boom-mounted pitot was regarded as the main one, it was a short L-shaped pitot head on the starboard side of the cockpit that provided air pressure data in normal flight. Additional pitch and yaw vanes were installed on the port side and underside of the nose, except on the first production examples.

Like the MiG-21R, the production MiG-21S interceptor had four wing pylons, the outer ones being plumbed for carrying drop tanks. In addition to the MiG-21PFM's weapons options (including R-3S and RS-2-US AAMs), it was able to carry R-3R (K-13R) missiles with SARH seeker heads.

The first prototype of the Ye-7S/*izdeliye* 95 version (c/n N95210101) served for verifying the radar and various systems. The second prototype ('92 Red', c/n N95210102) was used for testing the possibility of carrying four missiles instead of two. This aircraft was later donated to the Soviet Air Force Museum (now Central Russian Air Force Museum) in Monino south of Moscow. It is now painted up as '93 Red'. Production examples had alphanumeric c/ns – for example, N950SCh13 (N950СЧ13), which equals f/n 0713.

The MiG-21S remained in production at plant No. 21 in 1965-68 and was delivered solely to the Soviet Air Force. This version introduced a number of subtle changes (a reinforced nose landing gear unit, longer-stroke main gear oleos, perimeter seals on maintenance access panels, dirt seals on certain joints and so on) allowing the MiG-21S and later versions to operate from semi-prepared dirt strips in case of need.

Yet the designers' plan failed – the increase in internal fuel capacity did not produce the expected increase in combat radius for one simple reason. The interceptor's CG shifted aft as fuel was burned off, therefore the amount of usable fuel was limited in order to avoid a too-far-aft CG and hence stability/control problems. The normal all-up weight of the MiG-21S varied from 8,142 kg (17,950 lb) with two R-3S AAMs and the outer wing pylons removed to 8,376 kg (18,465 lb) with four R-3S missiles. The maximum speed was restricted to 2,175 km/h (1,351 mph) and the service ceiling was 18,000 m (59,055 ft).

All photos RSK MiG

▲
An uncoded brand-new MiG-21S in ground attack configuration with a GP-9 cannon pod and four UB-16-57UM rocket pods. Note the AoA sensor on the port side of the nose.

◄
Close-up of the rocket pods on the port (Nos. 1 and 3) wing pylons of a MiG-21S.

◄◄
Close-up of the GP-9 cannon pod under the fuselage of the same aircraft.

◄
This early-production MiG-21S carries R-3R semi-captive radar homing AAMs on the inner wing pylons and R-3S IR-homing AAMs on the outer pylons but no cannon pod. The missiles are in fact captive-carry training rounds (the R-3R is marked *oochebnyy* – instructional).

All photos RSK MiG

MiG-21SN Fishbed-J fighter-bomber (MiG-21N, Ye-7N, *izdeliye* 95N)

The MiG-21S evolved into a fighter-bomber version capable of delivering tactical nuclear weapons. It was designated MiG-21SN or MiG-21N; the manufacturer's product code was *izdeliye* 95N. The N suffix stood for *no**sit**el'* – carrier; the implied meaning was *no**sit**el' **ya**dernovo o**roo**zhiya* – nuclear weapon delivery vehicle. A single RN-25 tactical nuclear bomb was carried on the centreline on a main pylon and a small auxiliary rear support.

The prototype was completed in January 1965, passing tests that year. A small number of nuclear-capable MiG-21SNs was built and saw service with the Soviet Air Force.

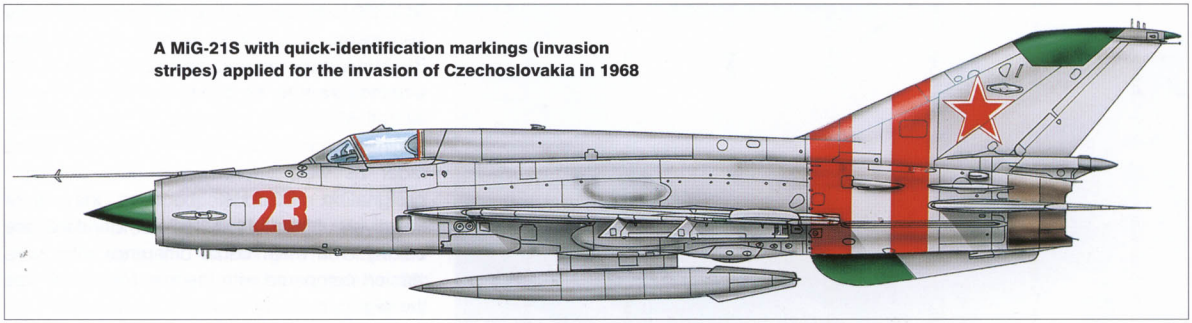
▲ **MiG-21S '02 Red' underwent State acceptance trials at GNIKI VVS. Here the fighter also carries a mix of SARH and IR-homing missiles but the order is reversed, with R-3Rs outboard. Note the absence of the rear view periscope.**

Maximum effective range at 10,000 m (32,810 ft) was 1,240 km (770 miles) on internal fuel, 1,490 km (925 miles) with one 490-litre (107.8 Imp gal) drop tank, 1,610 km (1,000 miles) with an 800-litre (176 Imp gal) drop tank and 2,100 km (1,304 miles) in ferry configuration with three 490-litre drop tanks but no missiles.

The MiG-21S had the NATO reporting name *Fishbed-J*.

MiG-21M Fishbed-J tactical fighter (Ye-7M, *izdeliye* 96; *Fishbed-J*)

As the MiG-21S entered production, the Mikoyan OKB developed an export version of this fighter designated MiG-21M (*moderni**zee**rovannyy* – upgraded); in the paperwork intended for the foreign customers the aircraft was referred to as the Ye-7M, while the manufacturer's product code was *izdeliye* 96. The fighter was powered



A MiG-21S with quick-identification markings (invasion stripes) applied for the invasion of Czechoslovakia in 1968

by an R11F2SK-300 turbojet (*izdeliye* 37F2SK) – the export version of the R11F2S-300; the K suffix denoted *kom**mehr**cheskiy* – 'commercial' (that is, export) version.

The MiG-21M differed from the domestic MiG-21S version in two important respects. Firstly, it had a somewhat downgraded avionics suite – the RP-22 (Sapfeer-21) radar was substituted by the older RP-21MA radar (the export version of the RP-21) linked to an ASP-PFD sight; the D stood for *dora**bot**annyy* – updated. Secondly, in keeping with the requirements of the foreign customers the Mikoyan OKB fitted the fighter with a built-in GSh-23L cannon replacing the earlier podded installation (the L suffix stood for *la**fet**naya* – adapted for installation on a permanent mount). The ammunition capacity remained unchanged at 200 rounds. It should be noted that the cannon could not be fired concurrently with the other weapons. The cannon was mounted in a very neat fairing with characteristic cooling air scoops located ahead of the centreline pylon; the cannon mount could be unlocked and winched down for maintenance and ammunition reloading. The No. 2 fuselage fuel tank had to be reshaped in order to provide room for the cannon's ammunition box.

Importantly, the cannon installation did not preclude the carriage of a centreline drop tank – even the 800-litre tank could be fitted. The drop tank's ground clearance remained unchanged.

Like the MiG-21S, the MiG-21M had four pylons and was able to carry four missiles at a time. However, the AAMs were strictly of the IR-homing R-3S model; the semi-active radar homing R-3R was not cleared for export.

The MiG-21M was equipped with an R-802V (RSIU-5) VHF radio, an ARK-10 ADF, an MRP-56P marker beacon receiver, an RV-UM low-range radio altimeter, an SOD-57M ATC transponder, an ARL-S Lazoor' GCI command link system, an SRZO-2 Khrom-Nikel' IFF interrogator/transponder, an SPO-3 Sirena-3M RHAWS and a KSI inertial compass system (*koorso**va**ya sis**tem**a inertsi**on**naya*). Late production MiG-21Ms had an AoA sensor fairing on the port side of the nose.

The MiG-21M's internal fuel capacity was 2,650 litres (583 Imp gal); the maximum fuel load was 2,200 kg (4,850 lb). Additionally, one, two or three 490-litre drop tanks were carried. The aircraft had an empty weight of 5,350 kg (11,795 lb) and a normal take-off weight of 8,840 kg (19,490 lb); the maximum all-up weight with three drop tanks was 9,800 kg (21,605 lb).

The MiG-21M entered flight test in 1968; that same year MMZ No. 30 'Znamya Truda' completed the first nine production examples. The MiG-21M had six-digit construction numbers; for example, Bulgarian Air Force MiG-21M '108 White' is c/n 960608 – that is, *izdeliye* 96, Batch 06, 08th aircraft in the batch (with typically 15 per batch).

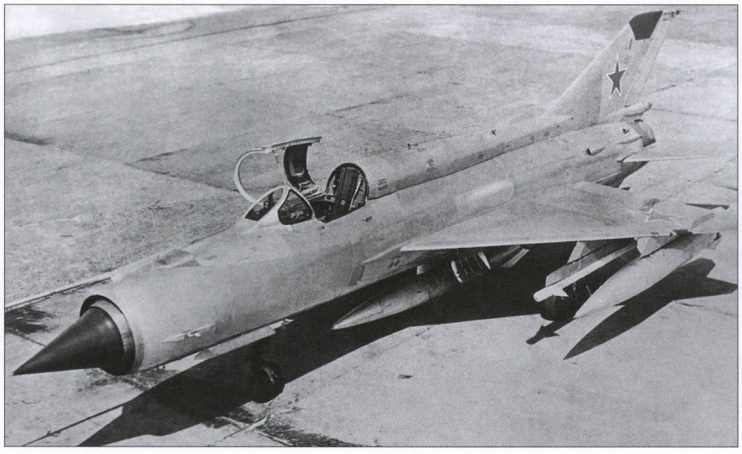
In June 1970 GNIKI VVS evaluated the MiG-21M as a launch platform for the Kh-66 air-to-surface missile. In October the same year the aircraft performed test drops of flare bombs.

The MiG-21M remained in production until 1971, being manufactured in several subtly different versions. For instance, the TS-27AMSh rear view periscope was added in the course of production. The type was delivered to the air forces of Bulgaria, Czechoslovakia, East Germany, Egypt, Poland, Romania, Syria and Yugoslavia. India went so far as to purchase a manufacturing licence for the MiG-21M; the first Indian-built example was delivered to the Indian Air Force on 14th February 1973.

The MiG-21M had the NATO reporting name *Fishbed-J*.

Most, if not all, Soviet-built MiG-21Ms were delivered without the rear-view periscope and the baffle plates beneath the auxiliary blow-in doors preventing gun blast gas ingestion. In some countries, however, these features were subsequently added. In contrast, all MiG-21Ms built under licence in India had these features from the outset.

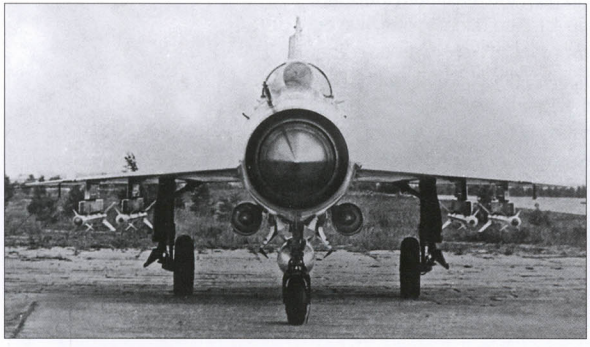
All photos Yefim Gordon archive

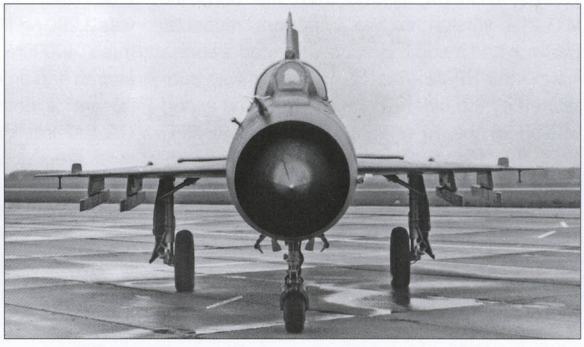


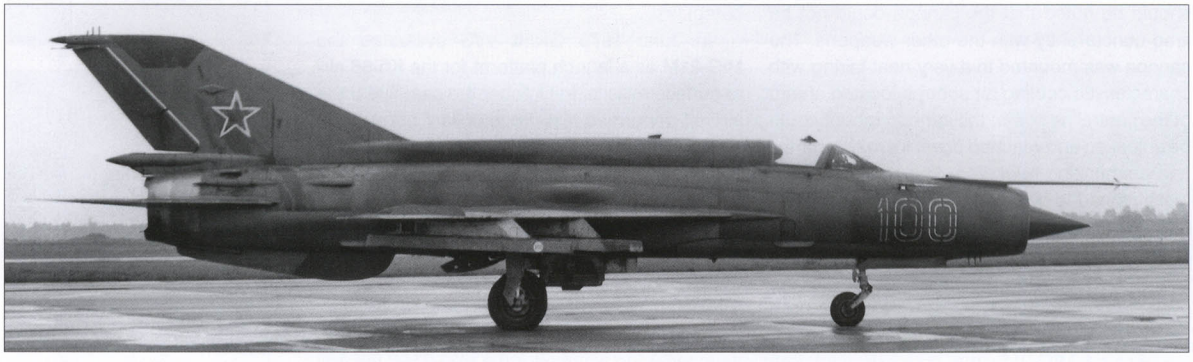
R13-300 turbojets. Such aircraft were unofficially designated MiG-21M Version B. The standard RP-21MA radar was usually retained, and the Czechoslovak Air Force unofficially called such aircraft MiG-21MA. However, some of the re-engined aircraft were retrofitted with the RP-22 radar as well; such aircraft bore the local designation MiG-21MF because they were effectively upgraded to MiG-21MF standard (see below). The main visual difference after conversion compared with the true MiG-21MF was the slightly different shape of the airbrakes.

MiG-21SM tactical fighter (*izdeliye* 95M, *izdeliye* 15, *Fishbed-J*)

The Mikoyan OKB decided to upgrade the MiG-21S by installing a new engine – the







▲▲▲ **An early-production MiG-21S with three PTB-490 drop tanks and two R-3S missiles.**

▲▲ **Head-on view of a MiG-21S with four R-3S AAMs and JATO boosters.**

▲► **A camouflaged MiG-21S coded '100 White outline'. Note the rear view periscope and the blast plates below the blow-in doors.**

MiG-21M tactical fighter (Ye-7M, *izdeliye* 96A, MiG-21M Version A, *Fishbed-J*)

The version of the MiG-21M intended for the USSR's Warsaw Pact allies was designated *izdeliye* 96A. Its flight performance and weapons options are presented in the following tables.

MiG-21M tactical fighter (MiG-21M Version B, MiG-21MA, *Fishbed-J*)

In some of the Warsaw Pact countries, including Czechoslovakia, individual MiG-21M (*izdeliye* 96A) fighters were re-engined with Tumanskiy R13-300 having a nominal thrust of 3,400 kgp (7,495 lbst), a maximum dry thrust of 4,070 kgp (8,970 lbst) and a maximum afterburner thrust of 6,490 kgp (14,310 lbst). The R13-300 had a 50% higher gas dynamic stability margin; it was also more reliable, easier to maintain and featured continuously variable afterburner thrust within a wide range. The SFC at nominal power was 0.91 kg/kgp·hr (lb/lbst·hr); the engine had a dry weight of 1,134.6 kg (2,501.3 lb).

Additionally, it was decided to install the GSh-23L cannon which had proved its worth on

the MiG-21M. The re-engined and cannon-armed derivative of the MiG-21S was designated MiG-21SM (that is, S-*modernizeerovannyy*). Apart from the powerplant, it was effectively a hybrid of the MiG-21S and the MiG-21M, combining the former version's radar with the latter aircraft's built-in cannon.

The MiG-21SM superseded the MiG-21S on the Gor'kiy production line in 1969, staying in production up to and including 1974. Since the latter type was known in-house as *izdeliye* 95, the MiG-21SM's product code was initially *izdeliye* 95M but was later changed to *izdeliye* 15 to confuse hypothetical spies. Again, the alphanumeric c/n system was used; for example, a Soviet Air Force MiG-21SM coded '35 White' is c/n 150 SO 01 (150 CO 01 in Cyrillic characters), which equals f/n 0301.

The changes were not limited to the powerplant and the addition of the built-in cannon, however. The MiG-21SM had a considerably updated avionics suite and an expanded weapons range. The RP-22 (Sapfeer-21) radar worked in conjunction with an ASP-PFD sight, which was specially modified for close-in dogfighting. Like the MiG-21S, the aircraft had an SPO-10 RHAWS; the windshield frame carried rear view mirrors. As in the case of the MiG-21M,

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◄ **A publicity shot of a Soviet Air Force MiG-21S from a somewhat unusual perspective.**

Flight performance of the MiG-21M (*izdeliye* 96A)

	with two R-3S AAMs	with four R-3S AAMs
Mach limit at 13,000 m (42,650 ft)	2.05	2.05
Maximum speed, km/h (mph):		
at high altitude	2,175 (1,350)	2,175 (1,350)
at sea level	1,150 (714)	1,150 (714)
Rate of climb, m/sec (ft/min):		
in full afterburner	120 (23,620)	120 (23,620)
at full military power	50 (9,840)	50 (9,840)
Service ceiling, m (ft)	18,000 (59,055)	16,800 (55,120)
Climb time from 500 m (1,640 ft) to 13,000 m in full afterburner, minutes	8.5	10.5
Range at 10,000 m (32,810 ft), km (miles):		
on internal fuel	1,200 (745)	1,100 (683)
with one PTB-490 drop tank	1,440 (894)	1,340 (832)
with one PTB-800 drop tank	1,560 (969)	1,460 (906)
with three PTB-490 drop tanks (no missiles)	1,950 (1,211)	–
Operational G limit	7	6
Take-off run in full afterburner, m (ft):		
with JATO boosters	500 (1,640)	550 (1,800)
without boosters	900 (2,950)	950 (3,120)
Landing run, m (ft):		
with brake parachute	550 (1,800)	550 (1,800)
without brake parachute	950 (3,120)	950 (3,120)
Unstick speed, km/h (mph):		
with JATO boosters	300 (186)	310 (192)
without boosters	320 (198)	330 (205)
Landing speed, km/h (mph)	270 (167)	270 (167)
Take-off weight, kg (lb)	8,212 (18,104)	8,451 (18,630)
Fuel load, kg (lb)	2,210 (4,870)	2,210 (4,870)
Landing weight (no missiles/ammo, 7% fuel reserves), kg (lb)	6,012 (13,253)	6,101 (13,450)

External stores options of the MiG-21M (izdeliye 96A)		
Inboard wing pylons	**Outboard wing pylons**	**Centreline pylon**
2 x R-3S	-	-
2 x R-3S	2 x R-3S	PTB-800
2 x UB-16-57U	2 x UB-16-57U	PTB-800
2 x S-24	2 x S-24	PTB-490
8 x FAB-100	-	PTB-490
8 x FAB-100	2 x FAB-100	-
2 x FAB-250	2 x FAB-250	PTB-490
2 x FAB-500	-	PTB-490
-	2 x PTB-490	PTB-490*
2 x OFAB-100	2 x OFAB-100	PTB-800
2 x S-24	2 x R-3S	PTB-800
2 x UB-16-57U	2 x R-3S	-
2 x R-3S	2 x PTB-490	-
2 x S-24	2 x PTB-490	-
2 x S-24	-	PTB-800
2 x FAB-250	-	PTB-800
2 x R-3S	-	SPRD-99
2 x R-3S	2 x R-3S	PTB-490 + SPRD-99
2 x UB-16-57U	2 x UB-16-57U	PTB-490 + SPRD-99
2 x S-24	2 x S-24	SPRD-99
2 x OFAB-100	2 x OFAB-100	PTB-490 + SPRD-99
8 x FAB-100	-	SPRD-99
2 x FAB-500	-	SPRD-99
-	2 x PTB-490	SPRD-99
2 x S-24	2 x R-3S	SPRD-99
2 x UB-16-57U	2 x R-3S	PTB-490 + SPRD-99
2 x S-24	-	PTB-490 + SPRD-99
2 x FAB-250	-	PTB-490 + SPRD-99

Note: In exceptional cases, two PTB-490 drop tanks and one PTB-800 drop tank can be carried

the installation of the cannon and its ammunition box necessitated changes to the No. 2 bladder tank; additionally, the aircraft was able to carry an 800-litre (176 Imp gal) centreline drop tank. Furthermore, baffle plates were fitted below the auxiliary blow-in doors to protect them from being blasted open when the cannon was fired.

The MiG-21SM's four wing hardpoints could carry various combinations of air-to-air and air-to-ground weapons: R-3S and R-3R AAMs, UB-16-57UM and UB-32 rocket pods with S-5 FFARs, bombs (the calibre was limited to 100 kg/220 lb) and napalm tanks. The permissible internal fuel quantity was limited to 2,650 litres (583 Imp gal). The fighter's normal all-up weight was 8,300 kg (18,300 lb).

The MiG-21SM became one of the Soviet Air Force's most widespread fighter types. Its refined aerodynamic layout, high thrust/weight ratio and tough structure, coupled with the autostabilisation system and the engine's high surge resistance when all standard weapons were used, earned the MiG-21SM a reputation as one of the world's best light fighters.

The MiG-21SM's NATO reporting name was *Fishbed-J*.

MiG-21SM aerodynamics testbed

In 1975 a single production MiG-21SM was converted into an aerodynamics testbed; the wings featured a modified airfoil, the standard rounded leading edge being replaced by a sharp one. Flight tests revealed a considerable improvement of flight performance; yet for various reasons the new wing design was not introduced on the production lines.

MiG-21MF tactical fighter (*izdeliye* 96F, Type 88, *Fishbed-J*)

As increasingly more capable versions of the MiG-21 were developed for the Soviet Air Force, their export equivalents differing slightly in avionics fit were brought out in short order. Thus, in due course the MiG-21M was refitted with the R13-300 engine and the RP-22 (Sapfeer-21) radar; the resulting version was designated MiG-21MF, the F denoting *for**see**rovannyy* and referring to the uprated powerplant. In effect, the MiG-21MF (known in-house as *izdeliye* 96F) was the export version of the domestic MiG-21SM. The weapons range was expanded by adding the R-60 short-range IR-homing AAM (later the R-60M; NATO code name AA-8 *Aphid*); the maximum ordnance load was 1,300 kg (2,870 lb). The MiG-21MF was equipped with the AP-155 autopilot, the Sirena-3M RHAWS, SRO-2 and SRZO-2 IFF transponders, the SOD-57M ATC transponder, the RV-UM radio altimeter and the Lazoor' GCI command link receiver. All MiG-21MFs were built with the TS-27AMSh rear view periscope.

The MiG-21MF's empty weight was 5,843 kg (12,881 lb). The take-off weight with two R-3S AAMs was 8,200 kg (18,080 lb), rising to 8,950 kg (19,730 lb) if two PTB-490 underwing drop tanks were added and to 9,400 kg (20,720 lb) with two AAMs and three drop tanks. The maximum TOW was 9,800 kg (21,605 lb). Because of the higher weight the fighter's service ceiling was reduced to 15,250 m (50,030 ft); on the other hand, range with three drop tanks was 1,800 km (1,118 miles).

The MiG-21MF entered production in 1970 – initially at MMZ No. 30 in Moscow, which was still manufacturing the MiG-21M at the time. As already mentioned, the latter version remained in production until 1971; both models used the same six-digit c/n system, and it appears that

MiG-21M/MF batches were interspersed during this time frame. The earliest known Moscow-built MiG-21MF is Czechoslovak Air Force '4306 Black' (c/n 964306). Moscow production ended in 1974 with Batch 99. In 1975 MiG-21MF production was transferred to the Gor'kiy aircraft factory No. 21. Gor'kiy-built examples had eight-digit c/ns incorporating the 'famous last five'; for example, Romanian Air Force '6707 Red' is c/n 96006707 and f/n 0520. Because MiG-21MF production at plant No. 21 began in 1975, some foreign air forces operating Moscow-built and Gor'kiy-built examples alike referred to the latter machines unofficially as 'MiG-21MF-75s'. Such aircraft had the same cockpit instrumentation (whatever that means!) as the MiG-21*bis* (see below) which had been in production there.

Again, India purchased a manufacturing licence for the MiG-21MF. The MiG-21MFs built by HAL bore the local product code 'Type 88'.

MiG-21MF development aircraft with Volk gunsight

In the late 1960s Maj. Gen. Protopopov, who headed one of the chairs at the Air Force Academy named after Nikolay Ye. Zhukovskiy (VVA – *Vo**yen**no-voz**doosh**naya aka**dem**iya*) in Moscow, proposed a new targeting method to be used against aerial and ground targets. This method involved dual superimposition of the sighting reticle on the target. The concept of the new computing gunsight using this method was developed by the Academy's research laboratory under the guidance of V. G. Katyushkin. The sight was code-named Volk (Wolf) and featured an analogue processor. A proto-type of the Volk gunsight was tested on the Su-7 fighter-bomber; this first version could be used only against ground targets, but flight tests of an air-to-air capable version began shortly afterwards.

A MiG-21MF refitted with the Volk sight was initially tested by GNIKI VVS in Akhtoobinsk. In the summer of 1973 the tests continued at the FA's 4th TsBP i PLS (*Tsentr boye**voy** podgo**tov**ki i pere**oo**chivaniya **lyot**novo sos**tah**va* – Combat & Conversion Training Centre) in Lipetsk, with I. I. Fyodorov as project test pilot. A MiG-21*bis* fighter (see below) flown by A. Smetanin, another 4th TsBP i PLS pilot, initially served as a practice target; the two fighters often pulled up to 7 Gs as they manoeuvred during mock dog-fights. Later, the testing was again transferred to GNIKI VVS where the MiG-21MF attacked target drones with cannon fire, using armour-piercing rounds. The results were encouraging; at a range of some 800 m (2,620 ft) the target could be destroyed at the expenditure of just four

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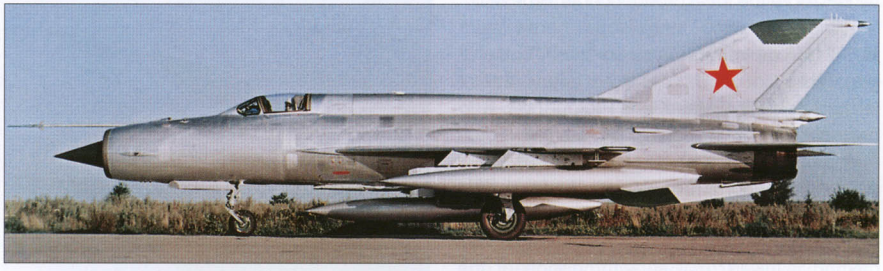
◄▲
'Black men' (technicians clad in regulation black fatigues) perform daily maintenance procedures on MiG-21S fighters. Note the scuffed paintwork on the rear fuselage of the fighter on the left.

◄
The crew chief of a MiG-21S reports to the pilot before a sortie. Note the different shades of the skin on various parts of the airframe.

All photos RSK MiG

▲ ▶
The MiG-21SM prototype with two R-3S missiles, two PTB-490 drop tanks under the wings and a PTB-800 centreline drop tank. The faired GSh-23L built-in cannon is visible ahead of the centreline pylon. This example lacks a rear view periscope.



▶
The same MiG-21SM carrying two R-3S missiles outboard and two multiple ejector racks (MERs) with FAB-100 bombs inboard.

rounds, notwithstanding the fact that the range had to be entered manually.

MiG-21MF camera ship

One of the Czechoslovak Air Force's Moscow-built MiG-21MFs ('7707 Black', c/n 967707) was outfitted as a camera ship for movie making purposes. One cine-camera was installed in the cockpit just aft of the windscreen to give a 'pilot's eye view', while another was carried in a special camera pod on the centreline pylon.

MiG-21RF tactical reconnaissance aircraft (*izdeliye* 96R, *Fishbed-H*)

Some countries operating the MiG-21R (*izdeliye* 94R) started refitting the reconnaissance jets with R13-300 engines after taking delivery of the similarly powered MiG-21MF. The modified aircraft were redesignated MiG-21RF (*izdeliye* 96F); to the NATO, however, this version was still known as the *Fishbed-H*.

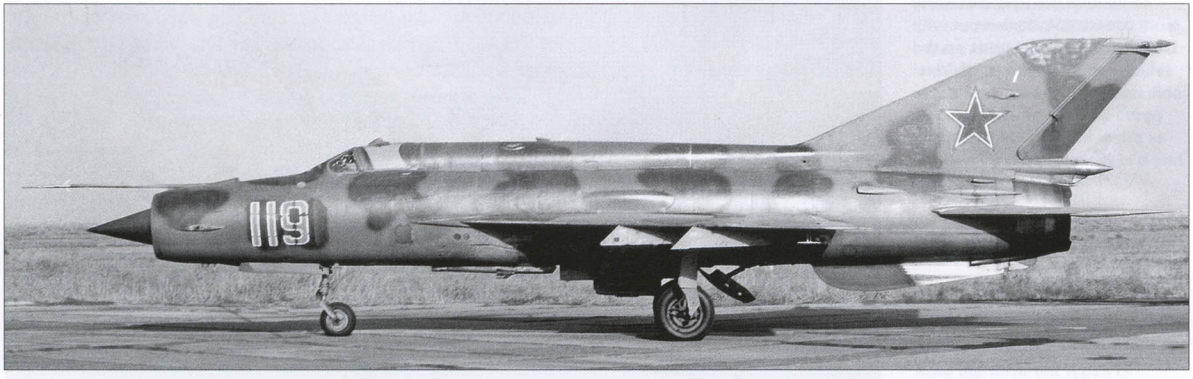
MiG-21DF (MiG-21D) development aircraft

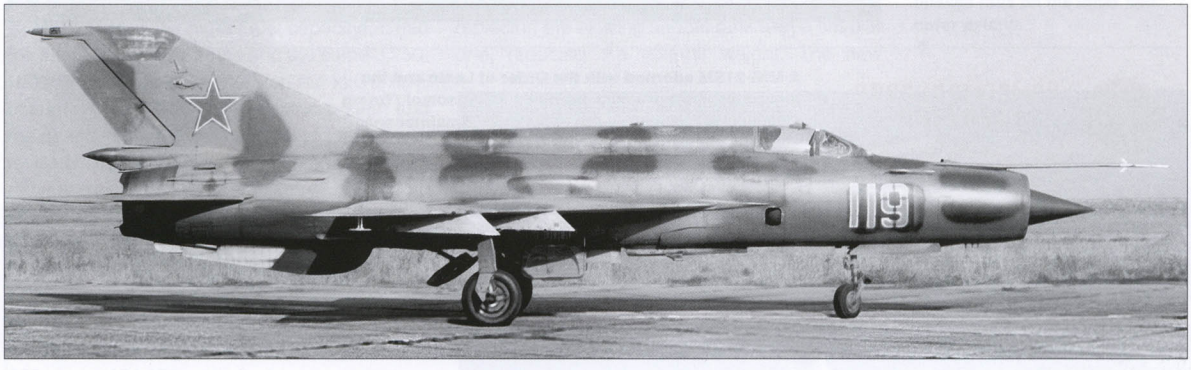
Each successive modification led to an increase in the MiG-21's take-off weight and hence to a reduction in manoeuvrability. This led some of the Soviet Air Force's top commanders to believe that the fire control radar was not really necessary for close-in dogfighting and, by replacing it with a simpler but lighter radar rangefinder, a more nimble dogfight version could be obtained. Hence in 1969 a production

MiG-21 (probably a MiG-21S or MiG-21SM) was refitted with the experimental R13F2-300 engine offering higher thrust and the Kvant (Quantum) radar rangefinder. The aircraft was armed with a GSh-23L built-in cannon and could carry AAMs, FFAR pods and bombs; the maximum ordnance load was increased to 2,000 kg (4,410 lb).

The modified aircraft was designated MiG-21DF, although the military used the simplified designation MiG-21D (for *dahl'no**mer*** – rangefinder). The machine underwent trials at GNIKI VVS in January-April 1971, being flown by several Air Force pilots, including the well-known test pilot V. N. Kandaurov. The trials revealed that manoeuvrability was indeed improved; yet the MiG-21DF was not put into production, nor were any operational aircraft updated to this standard.

All photos Yefim Gordon archive





MiG-21SMF development aircraft

In the autumn of 1970 GNIKI VVS started testing the MiG-21SMF tactical fighter prototype. It differed from the baseline MiG-21SM in having the uprated R13F2-300 engine. Like the MiG-21SM, the aircraft was equipped with the RP-22 radar and armed with up to four AAMs. The tests were completed in the summer of 1971, but the MiG-21SMF remained in prototype form.

MiG-21MT export tactical fighter (*izdeliye* 96T)

One of the MiG-21 family's greatest weaknesses, especially in the eyes of the military experts from 'friendly nations', was its inadequate range. Having developed several versions featuring a saddle tank in the fuselage spine (which was progressively enlarged), the designers were sorely tempted to increase the capacity of this tank even further. In February 1971 the Council

▲ **'119 Yellow', a MiG-21SM operated by a Soviet Air Force training unit. Production MiG-21SMs had two cooling air scoops on the cannon fairing. Note the rear view periscope and the absence of blast deflectors below the blow-in doors.**

Proudly wearing the 'Excellent aircraft' badge, MiG-21SM '37 Red' (formerly coded '65') taxies out for a training sortie. The missiles on the inboard pylons are inert practice rounds. Note the blast deflectors below the blow-in doors.

Another MiG-21SM from the same unit, '01 Red' (formerly coded '45'), taxies out with UB-16-57UM rocket pods on the inboard pylons.

All photos Yefim Gordon archive

A MiG-21SM adorned with the Order of Lenin and the legend *Komsomol'skaya garantiya* – Komsomol (Young Communist League) warranty [of proper maintenance]

A MiG-21SM with a PTB-800 drop tank

of Ministers sanctioned this by issuing a directive ordering an increase in the MiG-21's range.

Thus the Mikoyan OKB developed yet another export version designated MiG-21MT which was effectively the MiG-21M or MiG-21MF with an increased fuel capacity (hence the T suffix denoting ***top**livo*, fuel) and an uprated R13F-300 engine. Initially a saddle tank holding no less than 900 litres (198 Imp gal) was fitted but this turned out to be a bad idea – the grossly bulged fuselage spine created unwanted vortices, blanking out the vertical tail and spoiling the fighter's directional stability. Hence the capacity of the saddle tank had to be reduced to 600 litres (132 Imp gal); the overall internal fuel capacity was thus 3,250 litres (715 Imp gal) and the fuel load was 2,450 kg (5,400 lb). Even so, the fuselage spine was strongly convex, tapering off gradually to merge with the brake parachute housing. The radar and the weapons fit were identical to those of the MiG-21MF.

In 1971 MMZ No. 30 'Znamya Truda' built an initial batch of 15 MiG-21MTs (apparently c/ns 964001 through 964015); this version bore the product code *izdeliye* 96T. However, the MiG-21MT was never delivered to any foreign customer.

MiG-21SMT Fishbed-K tactical fighter (*izdeliye* 50, *Fishbed-K*)

A domestic equivalent of the MiG-21MT was developed for the Soviet Air Force. Designated MiG-21SMT (again, the T stood for ***top**livo* – that is, MiG-21SM with a higher fuel capacity), it had the same R13F-300 engine and the same 3,250-litre internal fuel capacity. As on the MiG-21MT, changes were made to the electric system and the air intake centrebody control algorithm was revised. The avionics suite included the RP-22 radar and a new VHF communications radio. The MiG-21SMT was armed with a GSh-23L cannon and was able to carry R-3S, R-3R, R-60 and R-60M AAMs, as well as UB-16-57U and UB-32 FFAR pods, S-24 heavy unguided rockets and bombs.

The extra fuel gave the MiG-21SMT a 200-250 km (124-155 miles) longer range as compared with the MiG-21SM. However, all other performance figures had deteriorated considerably – for instance, the service ceiling was reduced to 17,300 m (56,760 ft) and the climb time to 16,800 m (55,120 ft) increased to nine minutes. Also, the fighter was quite sluggish. Nevertheless, it was decided to launch production of the 'fatback' version at the Gor'kiy aircraft factory under the product code *izdeliye* 50; production took place in 1971-72. Early MiG-21SMTs (up to and including at least Batch 17) had alphanumeric c/ns; for instance, an uncoded example preserved in Moscow is c/n 500AT15 (f/n 1615). Later examples had eight-digit c/ns incorporating the 'famous last five'; for instance, a MiG-21SMT coded '10 Yellow' is c/n 50023100 (f/n 2120).

The MiG-21SMT's NATO reporting name is *Fishbed-K*.

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▲
Someone obviously forgot to remove the auxiliary intake covers from MiG-21SM '20 Blue' before this propaganda shot of 'valiant guardians of the Soviet skies' was taken. The underside of the nose and the anti-surge doors are not painted white as implied by the photo – it is a just trick of the light.

MiG-21ST tactical fighter (*izdeliye* 50)

Because of its generally poor performance and sluggish handling the MiG-21SMT was unpopular with first-line pilots. Since the pilots' complaints were too many and too frequent to ignore, the OKB and the Air Force decided to modify most of the in-service MiG-21SMTs by replacing the existing saddle tank with a smaller one, reducing the take-off weight. The new

A MiG-21SM with a PTB-800 drop tank takes off.
▼

Another MiG-21SM streams its brake parachute on landing. Note the different types of missile rails on the inner and outer pylons.
▼

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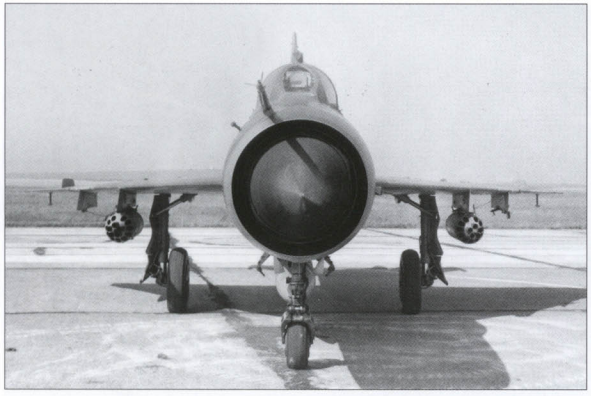
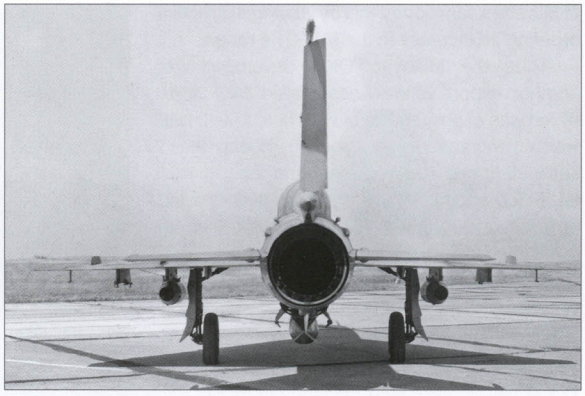
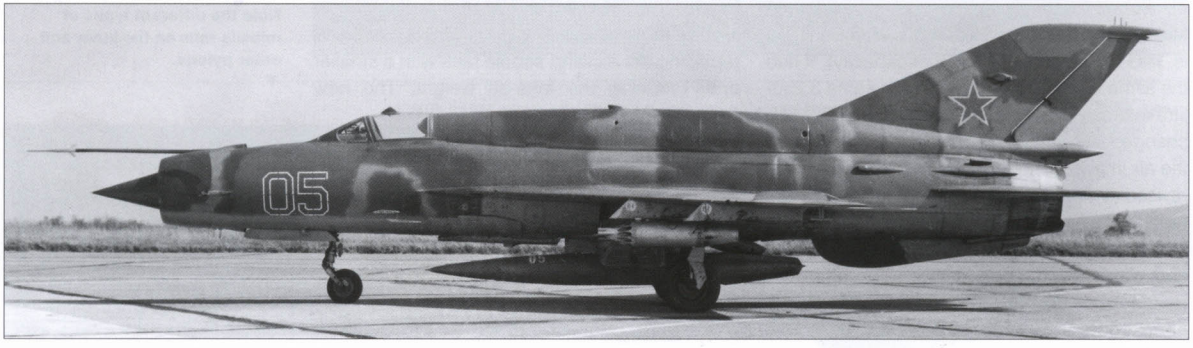
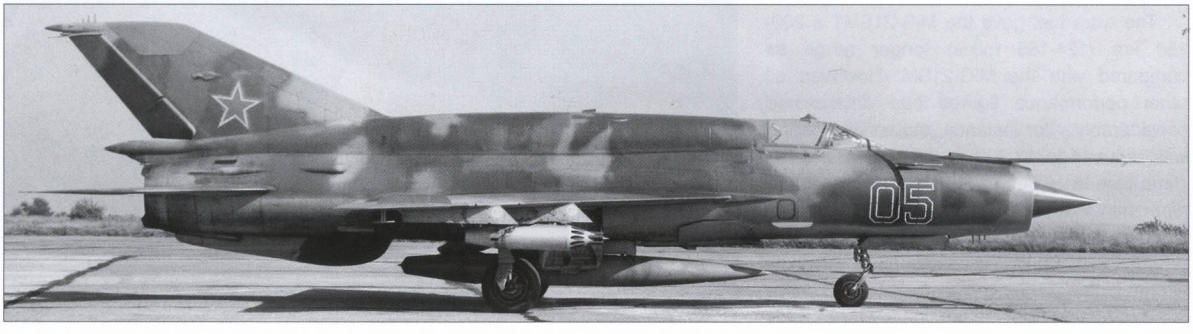




▲►
MiG-21SMT '05 White outline' in three-tone camouflage, with a PTB-490 drop tank and two UB-16-57UM FFAR pods.

More views of the same MiG-21SMT showing the grossly bulged fuselage spine.
▼





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saddle tank was borrowed from the MiG-21*bis*, which had by then entered production (see below). The fighters thus modified were redesignated MiG-21ST; the construction numbers and the product code *izdeliye* 50 remained unchanged. Outwardly the MiG-21ST was identical to the MiG-21*bis* (the *Fishbed-L* version) and could be distinguished from the latter only by the c/n commencing 500.

Two MiG-21STs, '76 Yellow' (c/n 50027021, f/n 2304) and '40 Yellow' (c/n 50029804, f/n 2317), are preserved in the Latvian Aviation & Technical Museum at Riga-Skulte.

MiG-21*bis* tactical fighter (Ye-7*bis*, *izdeliye* 75, *Fishbed-L/N*)

In the late 1960s, when the MiG-21's growth potential seemed to be exhausted, the Mikoyan OKB started work on a version optimised for low-altitude/high-speed operations. In February 1971 the Council of Ministers issued a directive calling for the development of aircraft meeting the Soviet Air Force's new general operational requirements. Among other things, the directive required the *Soyuz* (Union) engine design bureau based in Ufa, the capital of the Bashkirian Autonomous SSR, to develop a new engine for the MiG-21 and the Su-15 *Flagon* interceptor. The engine was required to deliver 7,100 kgp (15,650 lbst) for take-off and have a contingency rating briefly increasing the thrust to 9,600 kgp (21,160 lbst) during a low-level Mach 1 dash. In fact, this engine already existed, having been developed as a 'private venture'; the CofM directive merely gave it official status.

Indeed, the performance of the MiG-21 could at that point be further improved only by fitting a more powerful engine and a more capable radar. By 1971 Sergey K. Tumanskiy's OKB-300 had completed development of the R25-300 afterburning turbojet – the ultimate derivative of the R11. As compared with the latter model the take-off thrust was increased by 2,000 kgp (4,410 lbst) – the R25-300 delivered 7,100 kgp in full

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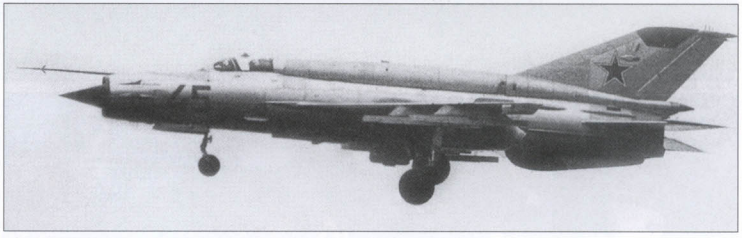

JAWA

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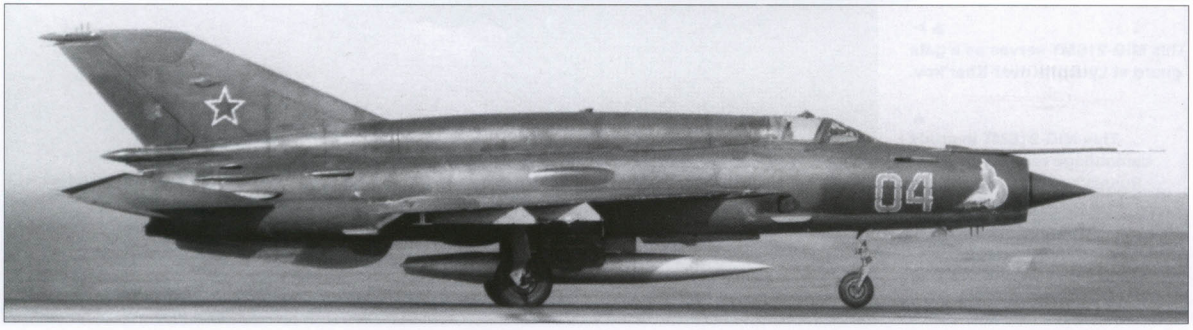
▲▲
Another camouflaged MiG-21SMT. Oddly, missile rails are attached to the inboard pylons only.

▲
A MiG-21SMT in its silver overall factory finish.

◄
This MiG-21SMT wears a two-tone camouflage scheme.

MiG-21SMT '04 Blue' was operated by GNIKI VVS and wore the institute's 'eagle and sun' badge.
▼



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Robert Ruffle

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afterburner. The contingency rating was even higher than required by the CofM directive – at altitudes up to 4,000 m (13,120 ft) the engine could deliver a maximum of 9,900 kgp (21,825 lbst) for up to three minutes. The re-engined aircraft was designated MiG-21*bis*.

Like the preceding model (MiG-21SM), the MiG-21bis could be fitted with two 2,500-kgp (5,510-lbst) SPRD-99 JATO boosters. The latter delivered a thrust impulse of up to 46,000 kg·m/sec for 10 to 17.8 seconds.

Meanwhile, OKB-155 kept searching for the optimum configuration of the MiG-21's fuel system that would provide the longest possible

▲▲ **MiG-21SMT '10 Yellow' (c/n 50023100) at the Latvian Aviation & Technical Museum in Riga.**

▲▲► **MiG-21SMT '11 Yellow' preserved at Arboga, Sweden.**

▲► **This MiG-21SMT serves as a gate guard at Lyubotin near Khar'kov.**

▲ **This MiG-21SMT in crude camouflage resides in one of Russia's aviation museums.**

► **Very weathered '15 Blue' used as a teaching aid at Dolgoye Ledovo near Moscow is actually not a MiG-21SMT but a rare MiG-21MT.**

Victor Drushlyakov

range without excessively compromising the other performance parameters. When it became clear that the MiG-21SMT's huge saddle tank caused an unacceptable reduction of flight performance and agility, the designers developed a new tank that looked like a cross between the tanks of the MiG-21SM/MiG-21MF and the MiG-21SMT. The upper fuselage contour was even, as on the former model, but the spine was wider and blended into the brake parachute housing, as on the MiG-21SMT. The internal fuel capacity was thus reduced to 2,880 litres (633.6 Imp gal) and the fuel load to 2,390 kg (5,270 lb), which was an increase of 190 kg (420 lb) over the MiG-21SM/MiG-21MF. Another change to the fuel system was the addition of a booster pump serving the afterburner. The MiG-21*bis* was provided with a new health and usage monitoring system (HUMS) that allowed routine maintenance to be performed much more quickly.

The more powerful engine, together with the aerodynamically cleaner fuselage spine and the optimum fuel load, produced a marked improvement in the fighter's flight performance. Not content with this, the designers improved the fighter's weapons; instead of two R-3S short-range AAMs the MiG-21*bis* carried four R-60 'dogfight AAMs' on APU-60-2 paired launch rails on the outer wing pylons as standard. The new

Eric Dewhurst

▲
MiG-21ST '40 Yellow' is one of two on display at the Riga museum.

A MiG-21MT in four-tone tactical camouflage, Dolgoye Ledovo airfield
14
A MiG-21MT in three-tone camouflage, Dolgoye Ledovo airfield
11
A MiG-21SMT in five-tone camouflage. Latvian Aviation & Technical Museum, Riga
10

RSK MiG

▲ **A MiG-21bis prototype with a PTB-800, two R-3S AAMs and four R-60 AAMs.**

Ground personnel receive instructions for the day's work beside a MiG-21*bis*. ▼

Blue-coded MiG-21*bis* fighters from Kubinka AB in diamond-four formation. ▼▼

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R-55 IR-homing AAM with a maximum range of 10 km (6.2 miles) became part of the Soviet Air Force inventory in 1968; this missile could also be carried by the MiG-21*bis*. The R-55 was produced and fielded on a small scale, though, being superseded by the R-60. The weapons options of the MiG-21bis also included the R-13M IR-homing AAM which had twice the launch range of the R-3S and was able to engage targets making high-G evasive manoeuvres. In mid-1982 the idea was floated that the R-60 should be replaced by the more refined R-60M version in the fighter's weapons range.

The MiG-21*bis* featured a more advanced Sapfeer-21M (or S-21M) fire control radar which was known as the RP-22M in production form. The ASP-PFD optical sight was modified, allowing certain restrictions on using cannon fire during high-G manoeuvres to be lifted.

The new version of the fighter entered flight testing in 1971. The following year the MiG-21*bis* entered production at the Gor'kiy aircraft factory, staying in production until 1974 (oddly enough, it was superseded by an earlier version, the MiG-21MF, at the Gor'kiy factory in 1975). It was manufactured in three versions; the domestic

Sergey Scrynnykov

variant supplied to the Soviet Air Force and the PVO was known as *izdeliye* 75, while the export versions were designated *izdeliye* 75A and *izdeliye* 75B (see below). The MiG-21*bis* became operational with the Soviet Air Force in 1972; this was the fighter's final production version.

The domestic versions for the VVS and the PVO differed in equipment fit. The air defence version was equipped with the ARL-S Lazoor'-M GCI guidance system, while the Air Force version had a *Polyot-OI* (Flight-OI) instrument landing system permitting landing approach with a cloudbase not lower than 100 m (330 ft) and a horizontal visibility of up to 1,000 m (0.62 miles). The ILS proved to be incompatible with the GCI guidance system, which had to be removed.

The Polyot-OI system worked with the azimuth/ranging beacons of the RSBN-2N or RSBN-4N short-range radio navigation system (RSBN = ***rah****diotekh****nich****eskaya sis****tem****a* ***blizh****ney navi****gah****tsii* – SHORAN; N = *na****zem****naya chast'* – ground-based components) and the localiser and glideslope beacon of the PRMG-4 ***Ka****tet-S* (Cathetus-S) ILS. This improved navigation accuracy considerably, permitting an instrument approach down to an altitude of 50-60 m (165-200 ft) in any weather.

Outwardly the Air Force version of the MiG-21*bis* equipped with the Polyot-OI ILS was readily identifiable by the two 'devil's pitchfork' aerials protruding forward beneath the air intake and aft from the fin tip. In contrast, the PVO version of the MiG-21*bis* equipped with the Lazoor'-M GCI guidance system lacked these aerials. The remainder of the systems and equipment was virtually identical to those of the MiG-21SM. Interestingly, in Soviet/Russian service both versions had the same product code, *izdeliye* 75 (unlike export examples whose product code varied depending on what system was fitted – see below).

The MiG-21*bis* saw service with nearly all Warsaw Pact nations (except Czechoslovakia), as well as with many 'third world' operators of the MiG-21 family. True to type, India bought a

via RART

via RART

via RART

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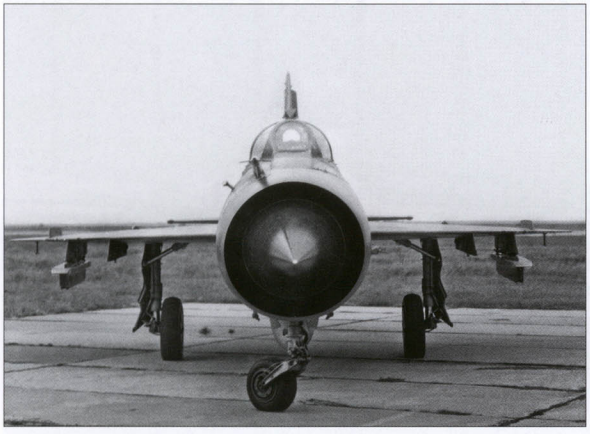
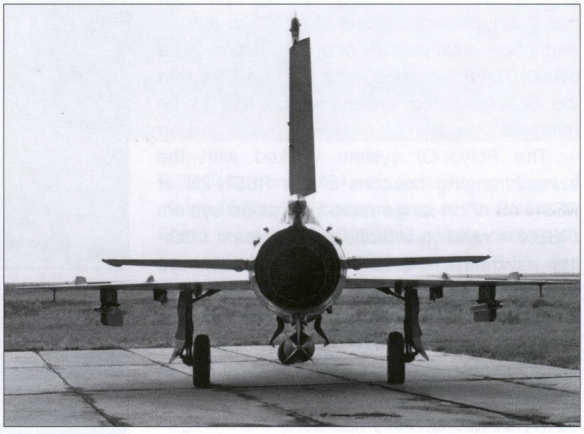
▲▲
234th GvIAP MiG-21*bis* fighters make a courtesy visit to Kuopio-Rissala AB, Finland, in 1978. '40 Blue' is inscribed *XVII s'yezd VLKSM* (17th Young Communist League Convention).

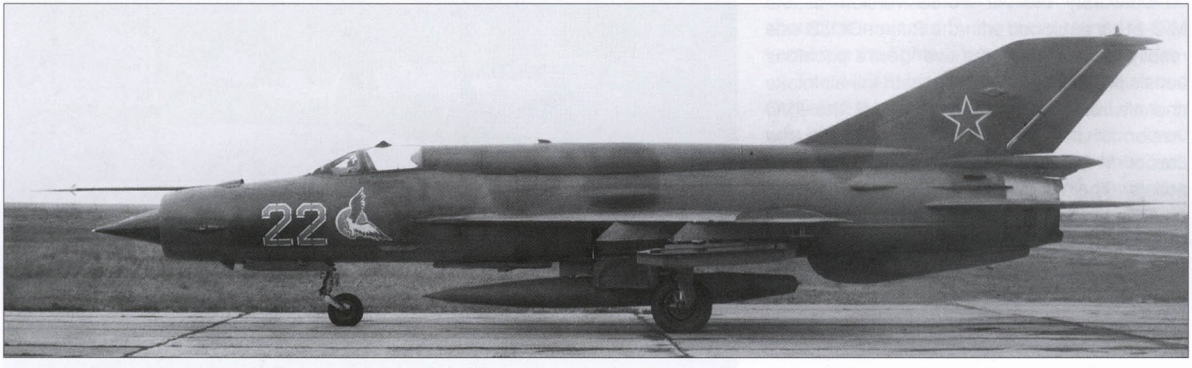
◄▲
MiG-21*bis* fighters in tactical camouflage and in air superiority grey (at Kubinka AB).

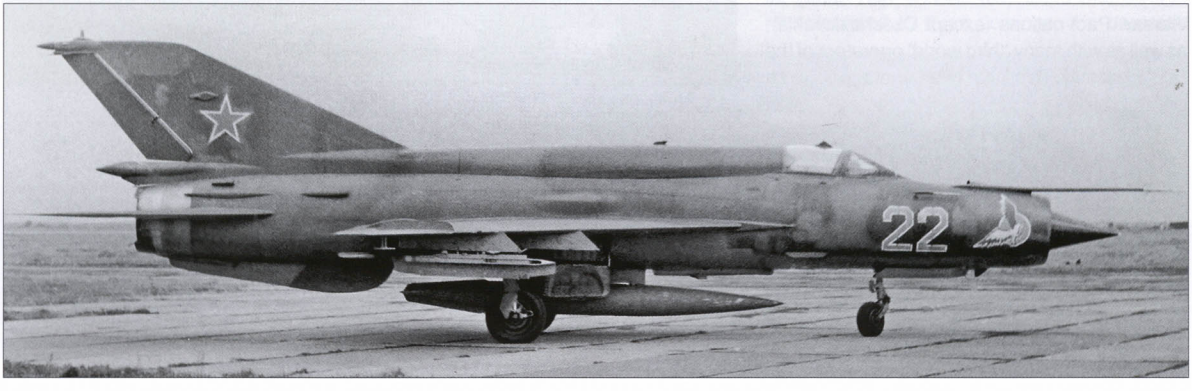
Five aspects of MiG-21*bis* '22 Blue' operated by GNIKI VVS. The fighter carries APU-60-2 dual missile launch rails under the wings and a PTB-490 drop tank on the centreline. Note the asymmetric placement of the GNIKI VVS 'eagle & sun' badge; the portside image is a mirror image of the one to starboard.

manufacturing licence for the new model; 225 examples were built by HAL. The MiG-21*bis* was offered at a much lower price than the General Dynamics F-16 Fighting Falcon, the most widespread American light fighter (which was also widely exported). Besides, the US government was rather choosy as to what nations were eligible as F-16 customers, which meant that some countries barred from purchasing the F-16 opted for the MiG-21*bis* instead. Another point in favour of the MiG-21*bis* was that the transition from an earlier version of the type did not entail any extra costs associated with re-equipment and conversion training. Air International pointed out in its December 1979 issue that the new missiles carried by the MiG-21*bis* turned it into a much more lethal adversary (as compared with the previous versions – *Auth.*). The magazine further stated that, while the MiG-21's limited combat radius remained its Achilles' heel, the fighter was quite a match for the F-16 as far as vertical and horizontal acceleration, speed and









All photos Yefim Gordon archive

turn radius were concerned – all parameters which were of paramount importance in a dogfight.

The lightweight, agile, well armed and cheap fighter soon became popular on the world arms market. Finland was one of the first foreign customers for the MiG-21*bis*, and the Finnish pilots rated the machine highly. Undeniably, the MiG-21*bis* was markedly inferior to the F-16 in certain respects but it had its strong points to make up for this; unsurprisingly therefore, by the early 1980s it had become the backbone of many air forces' fighter fleets.

Unlike most versions, the MiG-21*bis* had two NATO reporting names. The PVO version with the Lazoor' GCI guidance system was code-named *Fishbed-L*, while the Air Force version with the Polyot-OI ILS was the *Fishbed-N*.

MiG-21*bis* tactical fighter (*izdeliye* 75A, *Fishbed-L*)

The export version of the MiG-21*bis* with the Lazoor' system differing slightly in avionics fit had the in-house product code *izdeliye* 75A. It was operated by some Warsaw Pact countries, including Bulgaria, East Germany and Poland.

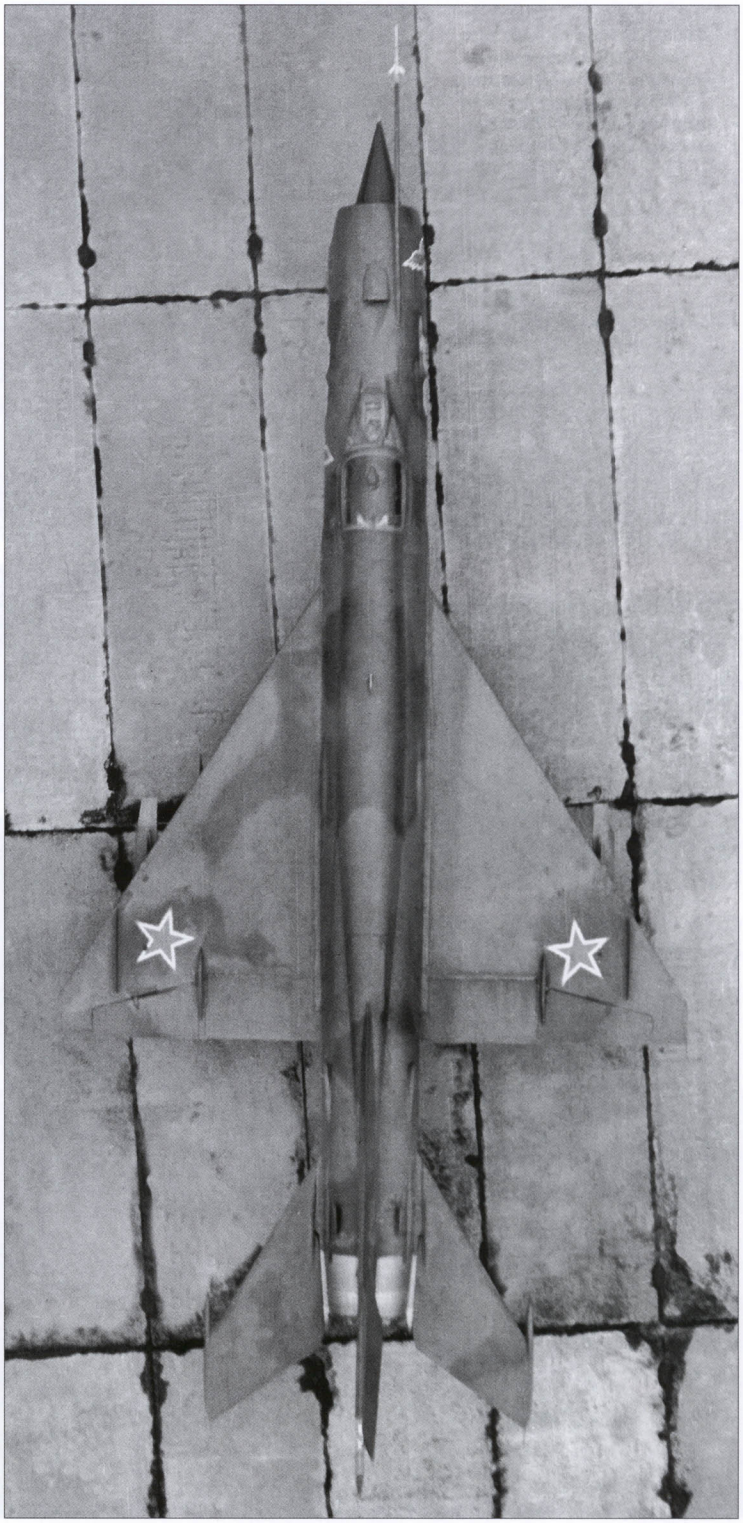
MiG-21*bis* tactical fighter (*izdeliye* 75B, *Fishbed-N*)

The similarly modified export version of the MiG-21*bis* with the Polyot-OI ILS was known as *izdeliye* 75B. It was supplied both to Warsaw Pact countries (Bulgaria, East Germany, Hungary and others) and to third-world countries. In some Warsaw Pact countries the *Fishbed-N* bore the unofficial local designation MiG-21*bis*-SAU (the latter is a Russian acronym for *sis**tem**a avtomat**ich**eskovo oopravl**en**iya* – automatic control system).

The MiG-21*bis* (*izdeliye* 75B) was built under licence by HAL in 1980-87.

MiG-21*bis* development aircraft with surge protection system

An early-production MiG-21*bis* coded '01 Red' (c/n 75002198) was fitted experimentally with an engine surge protection system. The fuselage nose was bulged immediately aft of the air intake lip, the result looking rather like the neck of a bottle. This bulge incorporated eight suction relief doors located around the circumference; the doors were powered by two actuators located in lateral fairings immediately aft of the circular bulge. This system augmented the existing powered lateral doors ahead of the cockpit and spring-loaded blow-in doors ahead of the wing leading edge. It allowed the airflow to



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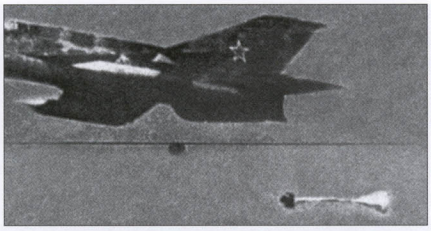

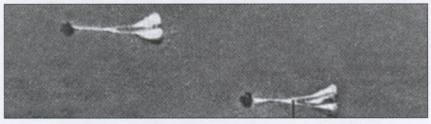

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▶
A MiG-21*bis* during tests with two KMGU-1 submunitions dispensers. Parachute-retarded bomblets or mines are seen following in the aircraft's wake before falling to the ground.

The one-off 'bottlenose' MiG-21*bis* with a modified air intake featuring an experimental surge prevention system.
▼

Close-ups of the modified nose, showing the bulged 'collar' incorporating surge prevention doors and the conduits blended into the 'collar'.
▶▼

The same aircraft in its latter days as an instructional airframe at the Kiev Air Force Institute in Ukrainian Air Force markings.
▼▼

the engine to be adjusted throughout the flight envelope, preventing compressor stalls during sharp manoeuvres with strong pitch and yaw. Part of the standard avionics and equipment, including the radar, was removed to make room for test equipment.

The 'bottlenose' MiG-21*bis* underwent tests but the modification was not cleared for production.

MiG-21*bis* avionics testbed with Polyot navigation system

A single MiG-21*bis* (identity unknown) became a testbed for the Polyot navigation system comprising the onboard components of the SHORAN system, a Romb-1K analogue data processor, an SKV-2N attitude and heading reference system (SKV = *sis**tem**a* ***koor**so-vert**ika**li* – AHRS) and an air data system. The test programme was undertaken by LII at Zhukovskiy.

Sergey Burdin

Sergey Burdin

Sergey Burdin

Sergey Burdin

E.Schmidt

E.Schmidt

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▲
Grey-painted MiG-21*bis* '08 Blue' adorned with the RSK MiG logo and a Russian flag is operated by the NAZ Sokol aircraft factory in Nizhniy Novgorod. Here it is seen at Zhukovskiy. Note the triangular blade aerials of the *izdeliye* 6201 IFF transponder.

◄▲
The same aircraft makes a training flight at Zhukovskiy in the days prior to the MAKS-2005 airshow. Note the rudder painted in faded camouflage colours – obviously a replacement item.

MiG-21*bis* '53 White outline' was a demonstrator for the MiG-21-93 upgrade, carrying dummy R-77 (RVV-AE) and R-73 AAMs.
▼

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A MiG-21*bis* *Fishbed-L* inscribed *Komsomol'skaya garantiya* (Komsomol warranty [of proper maintenance])

A 234th GvIAP MiG-21*bis* *Fishbed-L* inscribed *XVII s'yezd VLKSM* (17th Young Communist League Convention), 1978

A MiG-21*bis* *Fishbed-N* with the Guards badge and the legend *Sovetskaya Litva* (Soviet Lithuania)

A MiG-21*bis* *Fishbed-L* in tactical camouflage, the 1980s

'MiG-21*bis* No. 908' weapons testbed

In order to provide the closest possible simulation of in-flight conditions during ground tests of various systems and weapons, the need arose to design and build ground test rigs featuring the jet engines of existing or prospective aircraft. Such rigs would be used for performing missile and rocket launches at the NIPAV test range in Faustovo near Moscow (*Na**ooch**no-ispy**tah**tel'nyy poli**gon** aviatsi**on**-novo vo'oru**zhen**iya* – Aircraft Weapons Research & Test Facility). They would feature actual aircraft suspended on special fixtures.

This kind of simulation was considered proper because the motion of the rocket or missile with respect to the aircraft would be pretty much the same, regardless of whether the aircraft itself was moving (flying) or stationary. For the purpose of holding such tests the Mikoyan OKB teamed up with OKB-2-300 and LII to create the 21-L-11 ground test rig based on a MiG-21 airframe and convert a further MiG-21*bis* into a weapons testbed. The latter aircraft was referred to in LII documents as 'MiG-21 No. 908', the figures being the last three digits of the aircraft's c/n (750**908) or f/n.

A MiG-21*bis Fishbed-N* in special colours with the Guards badge superimposed on the Air Force flag

A MiG-21*bis Fishbed-N* operated by an Air Force pilot college

A MiG-21*bis Fishbed-N* operated by the Nizhniy Novgorod aircraft factory (NAZ Sokol) in demonstrator colours

Another MiG-21*bis* operated by NAZ Sokol (this time a *Fishbed-L*), Zhukovskiy, August 2005

MiG-21 avionics testbed with AAM guidance system

As part of the effort to develop the MiG-31 *Foxhound* heavy interceptor, in 1970 a MiG-21 (version and identity unknown) was converted into a testbed for the guidance system of the K-33 long-range radar-homing AAM (known as the R-33/NATO AA-9 *Amos* in production form).

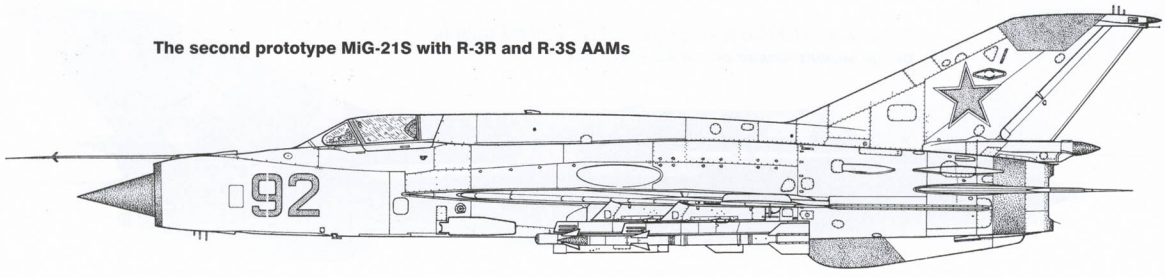
MiG-21UPGRADE PROGRAMMES

MiG-21-2000 multi-role fighter

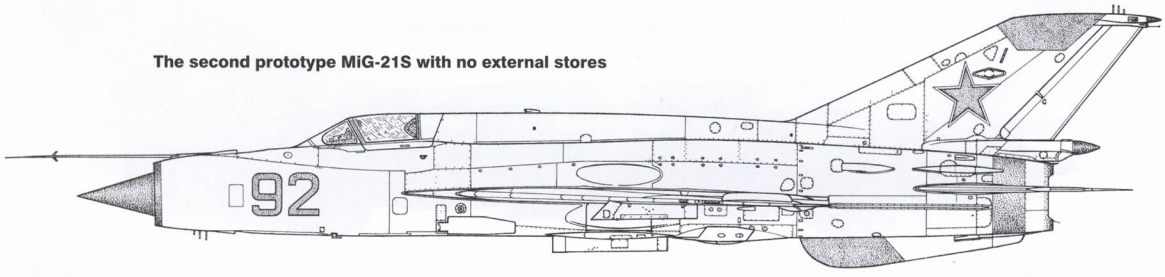
In early 1993 the Israel Aircraft Industries (IAI) concern and the Israeli company Elbit entered an agreement with the Romanian company Aerostar (formerly IAR Braşov). Under the terms of the contract IAI was to develop an upgrade programme for the Romanian Air Force (RoAF) MiG-21s, Elbit was to supply the new avionics and Aerostar was to undertake the actual conversions. The contract envisaged upgrading part of the RoAF's MiG-21 fleet – about 100 fighters.

The upgraded aircraft was eloquently designated MiG-21-2000. The prototype was converted from a MiG-21*bis* (c/n unknown) purchased by IAI from the Federal Nigerian Air

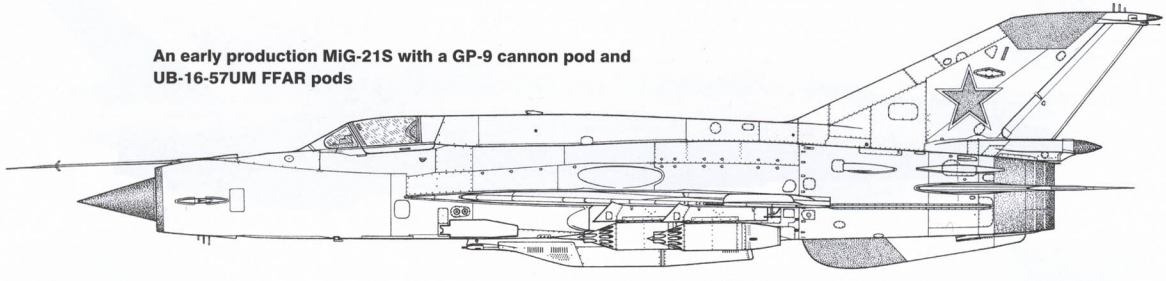
The second prototype MiG-21S with R-3R and R-3S AAMs



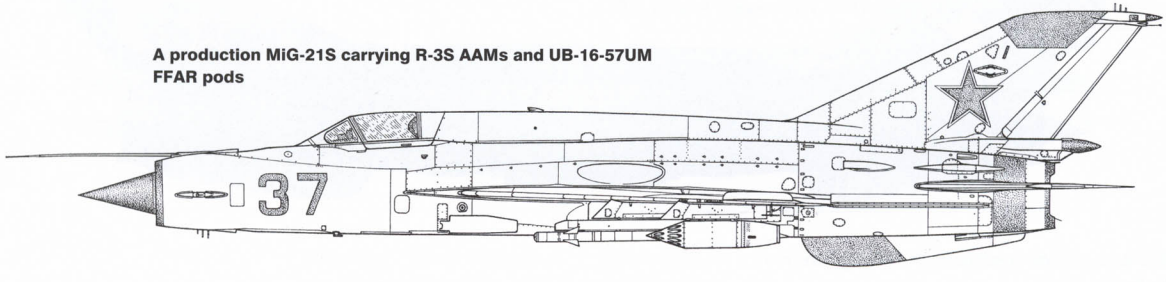
The second prototype MiG-21S with no external stores



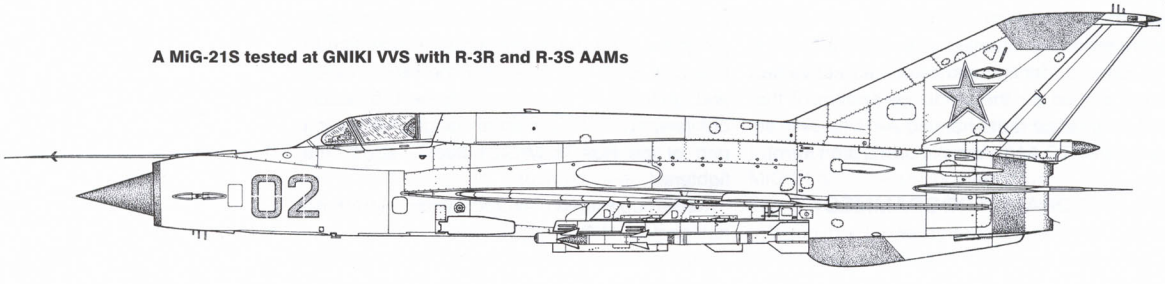
An early production MiG-21S with a GP-9 cannon pod and UB-16-57UM FFAR pods



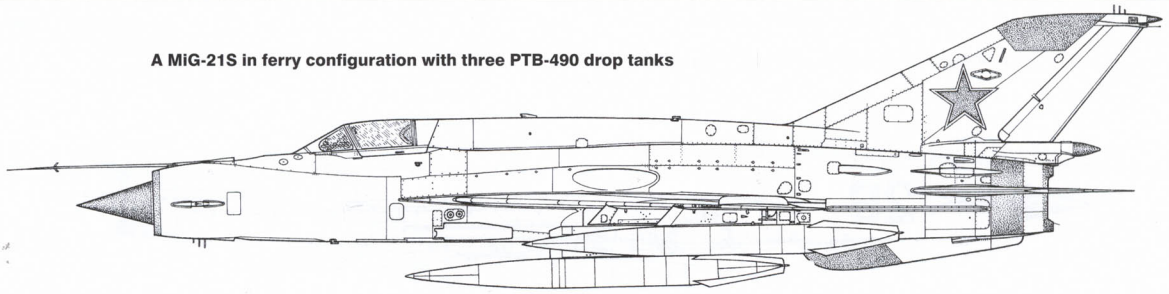
A production MiG-21S carrying R-3S AAMs and UB-16-57UM FFAR pods



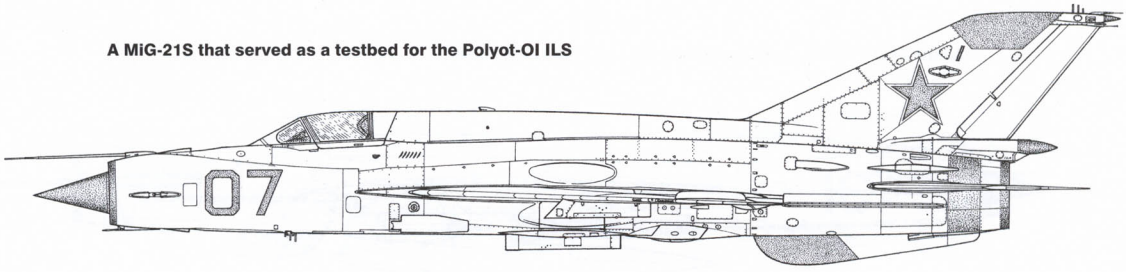
A MiG-21S tested at GNIKI VVS with R-3R and R-3S AAMs



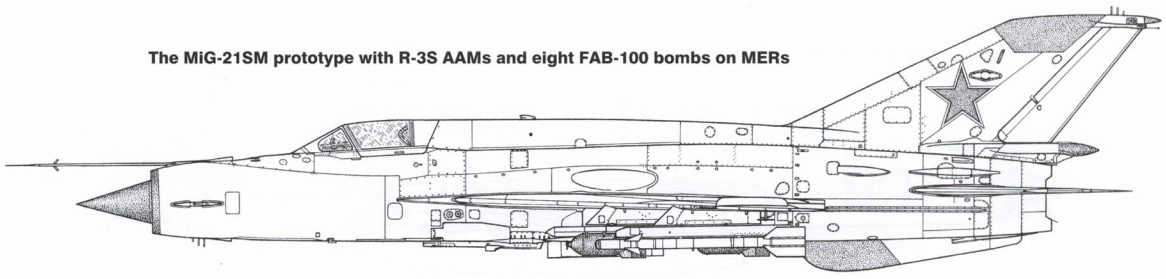
A MiG-21S in ferry configuration with three PTB-490 drop tanks



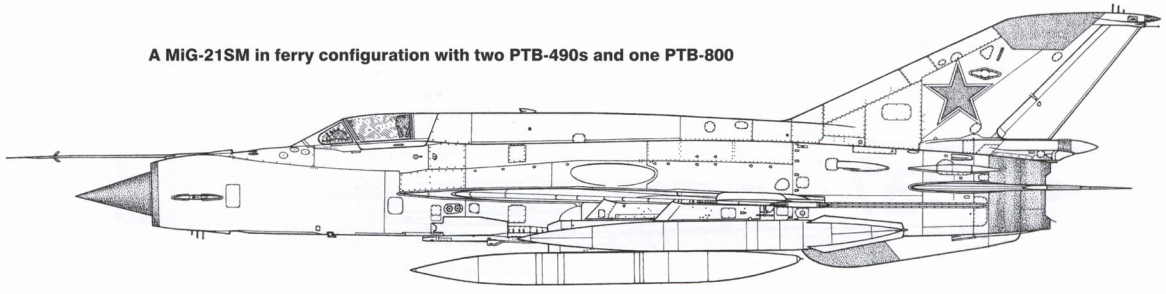
A MiG-21S that served as a testbed for the Polyot-OI ILS



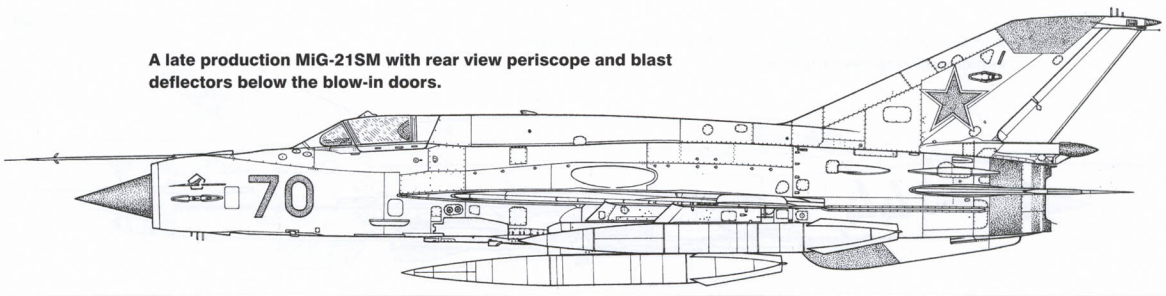
The MiG-21SM prototype with R-3S AAMs and eight FAB-100 bombs on MERs



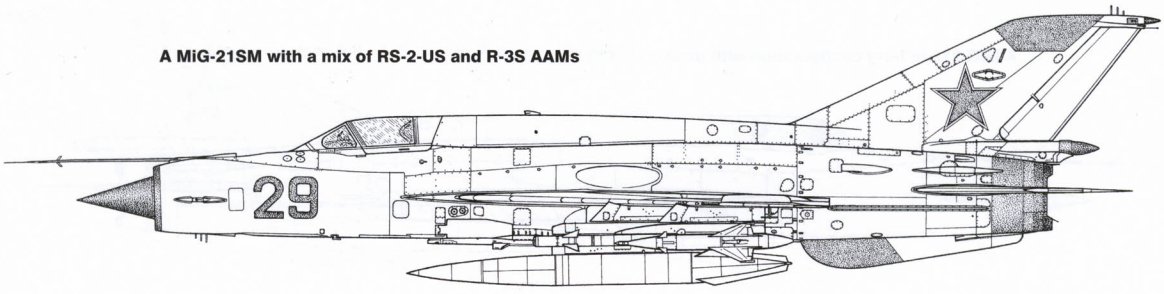
A MiG-21SM in ferry configuration with two PTB-490s and one PTB-800



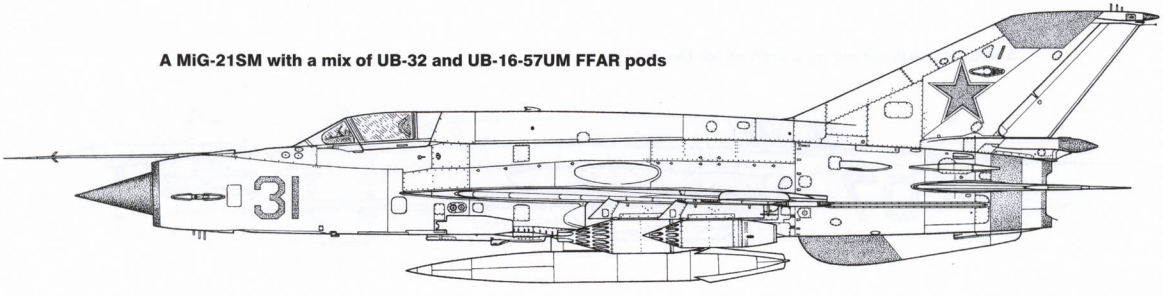
A late production MiG-21SM with rear view periscope and blast deflectors below the blow-in doors.



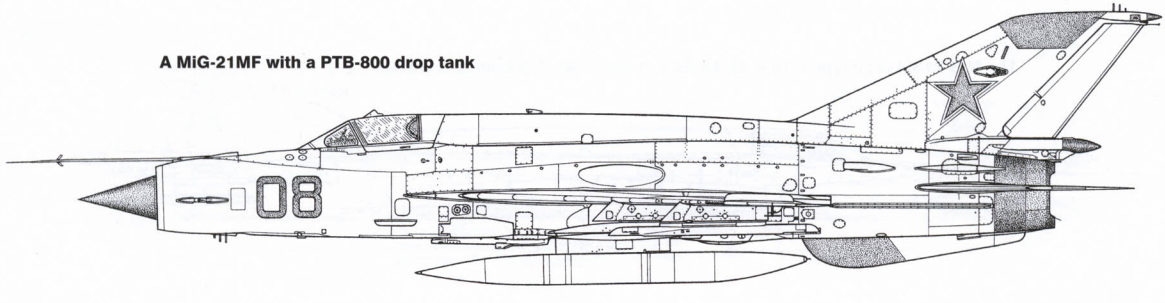
A MiG-21SM with a mix of RS-2-US and R-3S AAMs



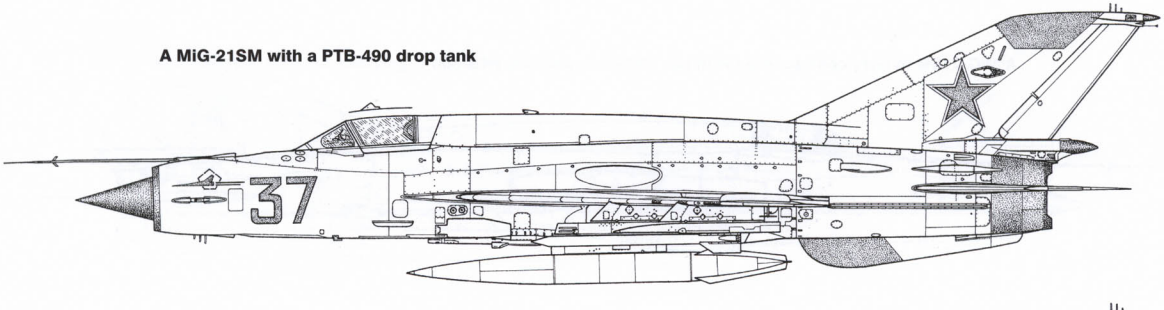
A MiG-21SM with a mix of UB-32 and UB-16-57UM FFAR pods



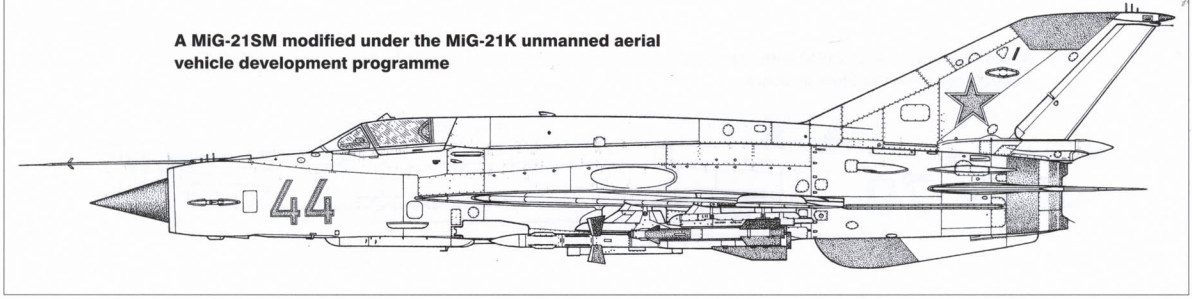
A MiG-21MF with a PTB-800 drop tank



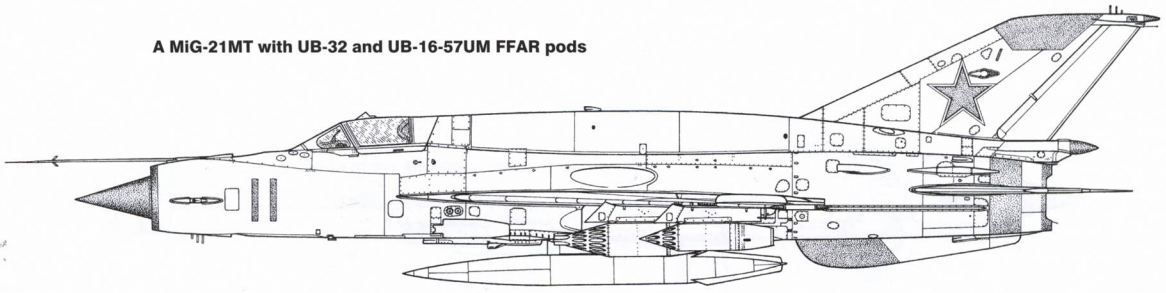
A MiG-21SM with a PTB-490 drop tank



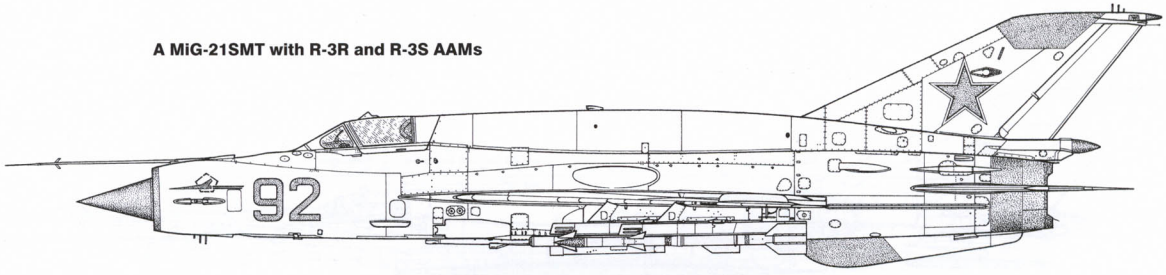
A MiG-21SM modified under the MiG-21K unmanned aerial vehicle development programme



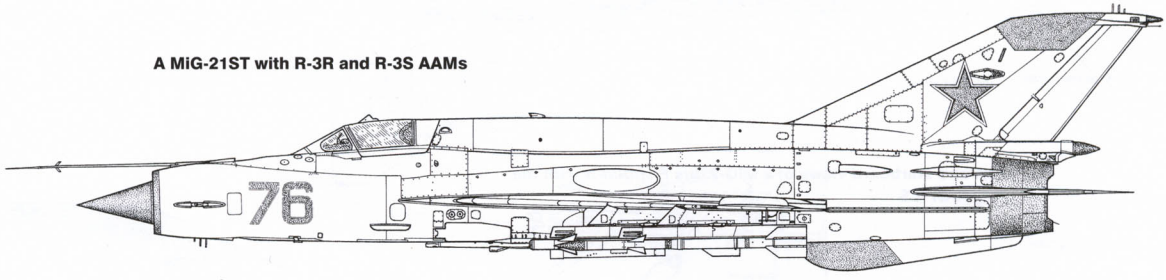
A MiG-21MT with UB-32 and UB-16-57UM FFAR pods



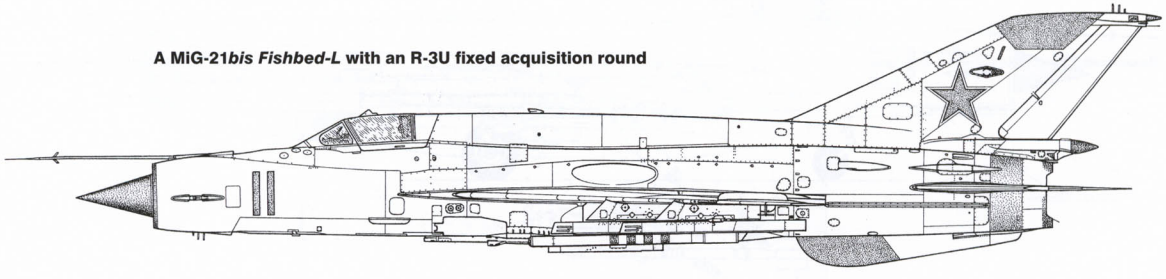
A MiG-21SMT with R-3R and R-3S AAMs



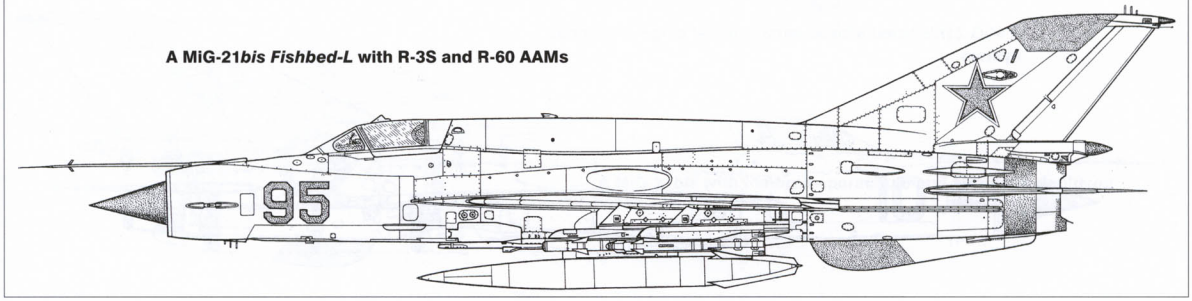
A MiG-21ST with R-3R and R-3S AAMs



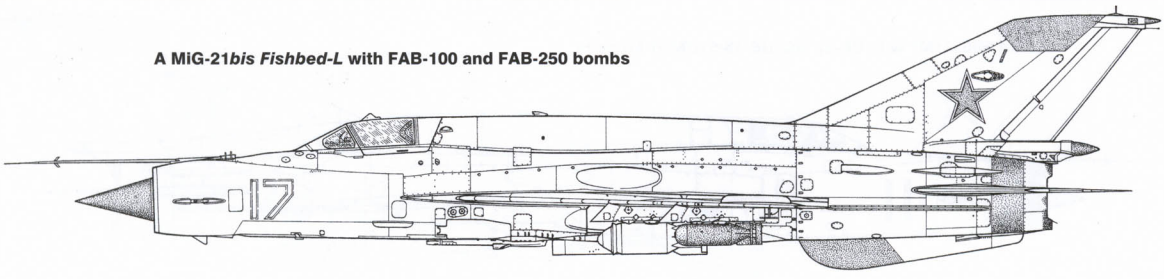
A MiG-21*bis Fishbed-L* with an R-3U fixed acquisition round

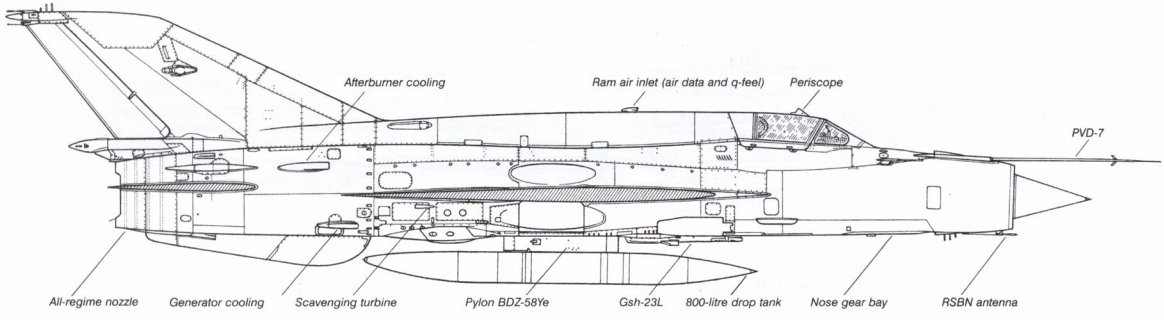


A MiG-21*bis Fishbed-L* with R-3S and R-60 AAMs

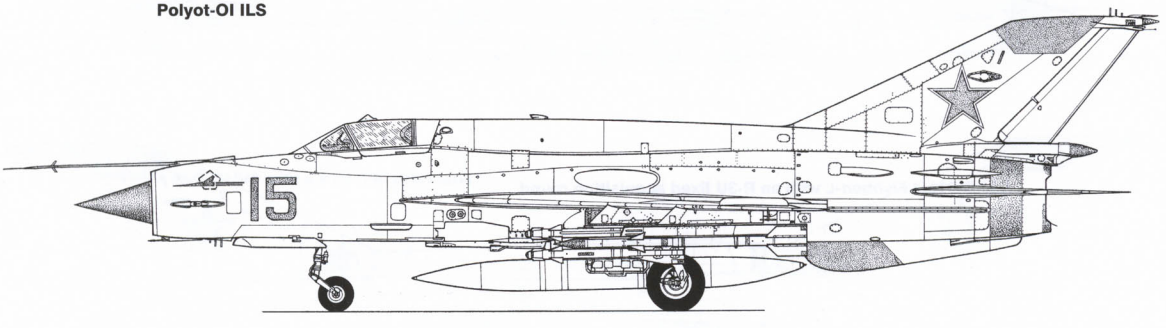


A MiG-21*bis Fishbed-L* with FAB-100 and FAB-250 bombs

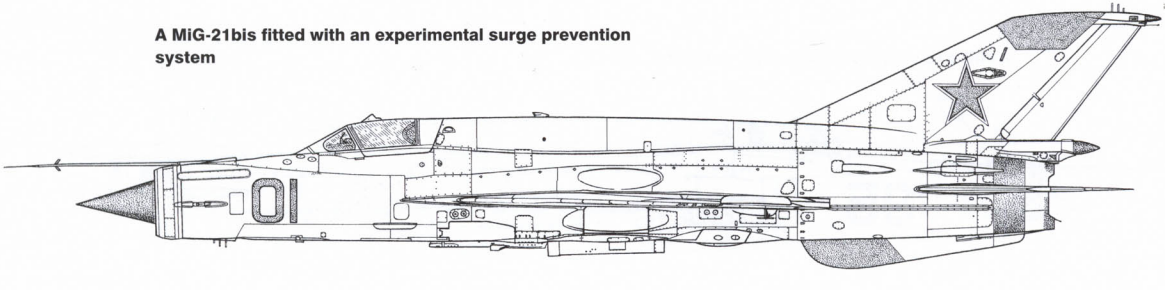


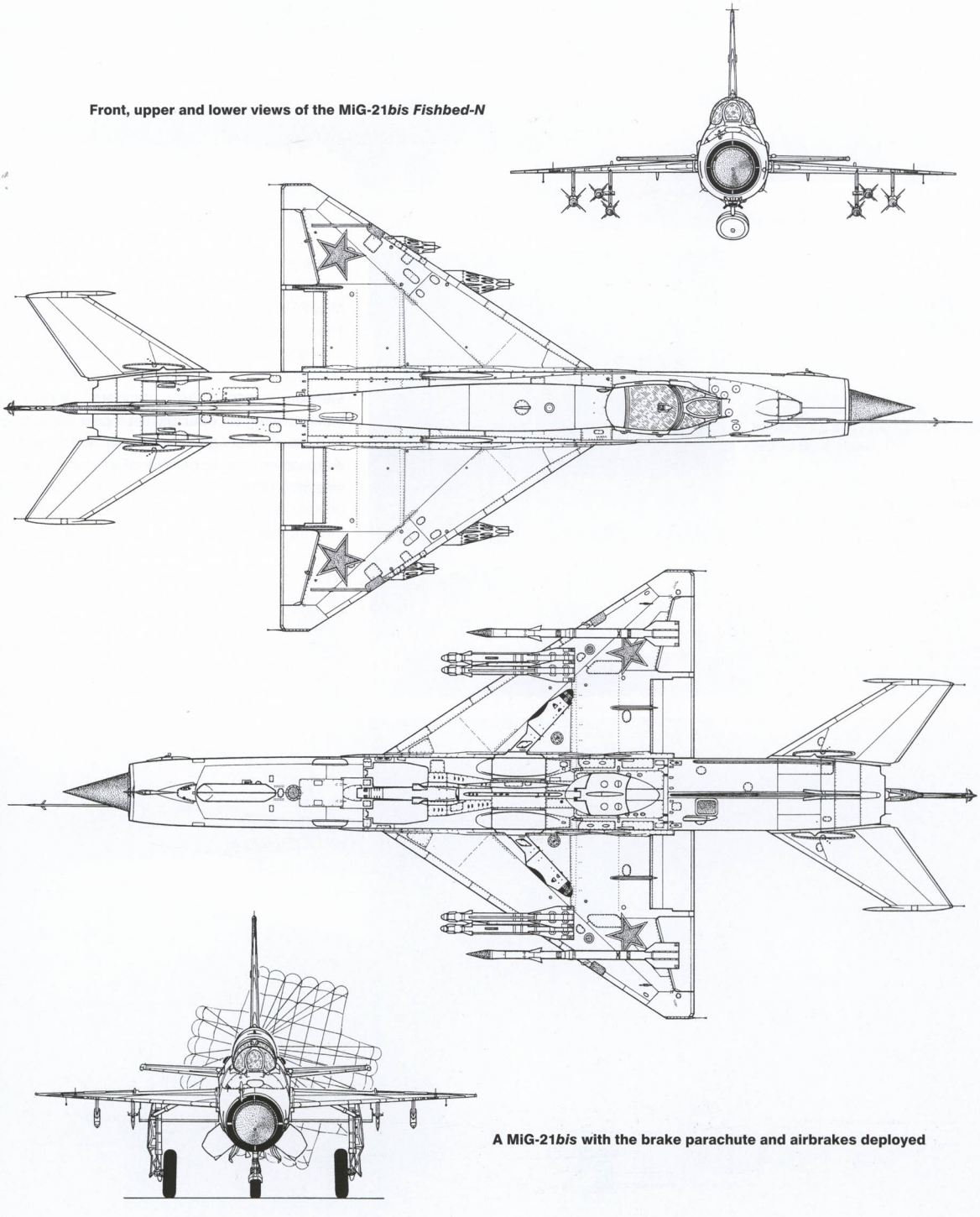


Port and starboard views of a MiG-21*bis Fishbed-N* with the Polyot-OI ILS



A MiG-21bis fitted with an experimental surge prevention system





Front, upper and lower views of the MiG-21*bis* *Fishbed-N*

A MiG-21*bis* with the brake parachute and airbrakes deployed

Ronen Eckstein

IAI 802, a MiG-21*bis* converted as a MiG-21-2000 demonstrator. Note the chaff/flare dispenser.

IAI

A cockpit mock-up of the MiG-21-2000 with two Elbit MFDs and a HUD/UFCP.

This MiG-21-2000 (a converted *Fishbed-N*) shows the one-piece windshield and the new seat.

Force – a rather odd fact, considering that the prospective customer (the RoAF) operated the MiG-21M and MiG-21MF but not the MiG-21*bis*. The silver-painted aircraft was serialled IAI 802.

The existing KM-1M ejection seat was replaced by a Martin Baker Mk 16 zero-zero ejection seat. The standard windshield incorporating an optically flat triplex windscreen and two sidelights was replaced with a wraparound acrylic bird-proof windshield, which was 50% stronger and offered a much better field of view. (However, MiG-21-2000 IAI 802 retained the original windshield – at least initially.) The

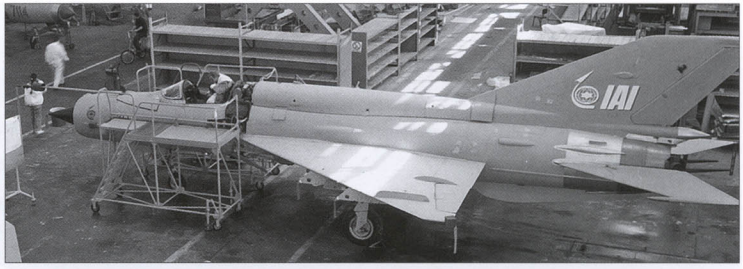
IAI

greater part of the fighter's avionics was also substituted with Israeli ones.

The upgrade centred on integrating modern western-standard mission avionics – primarily the weapons control system (WCS) and updating the cockpit controls and data presentation systems. The MiG-21-2000 featured a data presentation and control system developed by Elbit, comprising multi-function displays (MFDs) and a special DASH helmet incorporating a helmet-mounted sight (HMS; DASH stands for Display And Sighting Helmet). The cockpit utilised the 'hands on throttle and stick' (HOTAS) concept. The instrument panel featured three liquid-crystal displays (including two MFDs) and a head-up display/up-front control panel (HUD/UFCP) facilitating the use of the fighter's avionics and systems. The HMS allowed the pilot to achieve target lock-on and fire an AAM by simply looking at the target – the missile's seeker head was automatically oriented in the right direction. This device did not have a beyond visual range (BVR) IFF function; however, IAI spokesmen hinted that the East European customers who might order the MiG-21-2000 upgrade probably would not use Western IFF systems.

The fighter's avionics had an open architecture developed by Lahav, a division of IAI (new items could be readily integrated to suit customer requirements). The navigation suite included an inertial navigation system/global positioning system (INS/GPS) and a navigation processor connected to a MIL-STD-1553B databus. This allowed the MiG-21-2000 to deliver bomb strikes, using the CCIP (continuously computed impact point) and Dive-Toss techniques. The RP-22 radar was substituted with an Elta Electronics EL/M-2032 radar and an ECM system was added; also, MiG-21-2000 IAI 802 had infrared countermeasures (IRCM) flare dispensers mounted low on the rear fuselage sides.

The GSh-23L cannon was retained – IAI chose to leave well enough alone. External stores were carried on the existing five hardpoints; the MiG-21-2000 could carry up to 1,500 kg (3,310 lb) of ordnance. For close-in air



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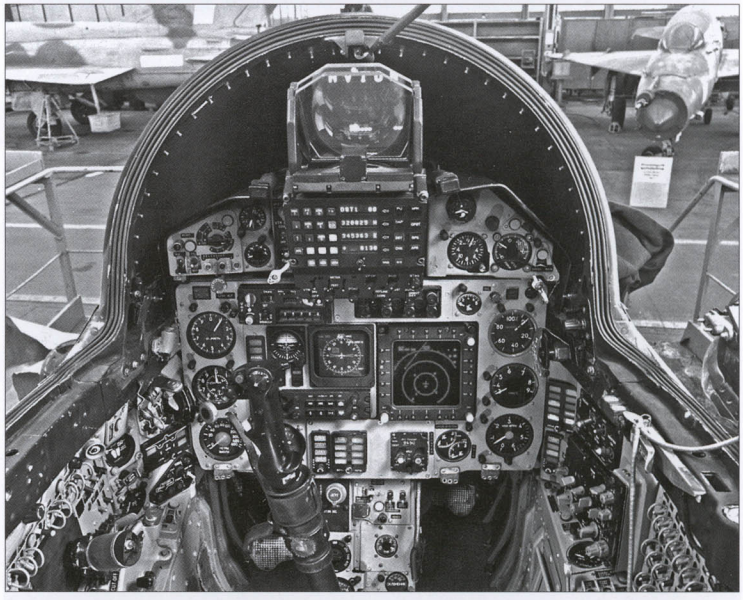
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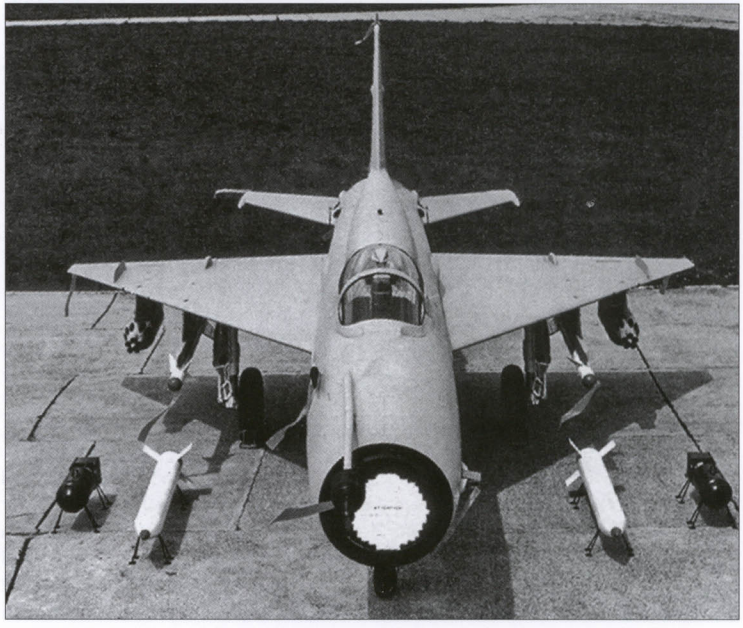
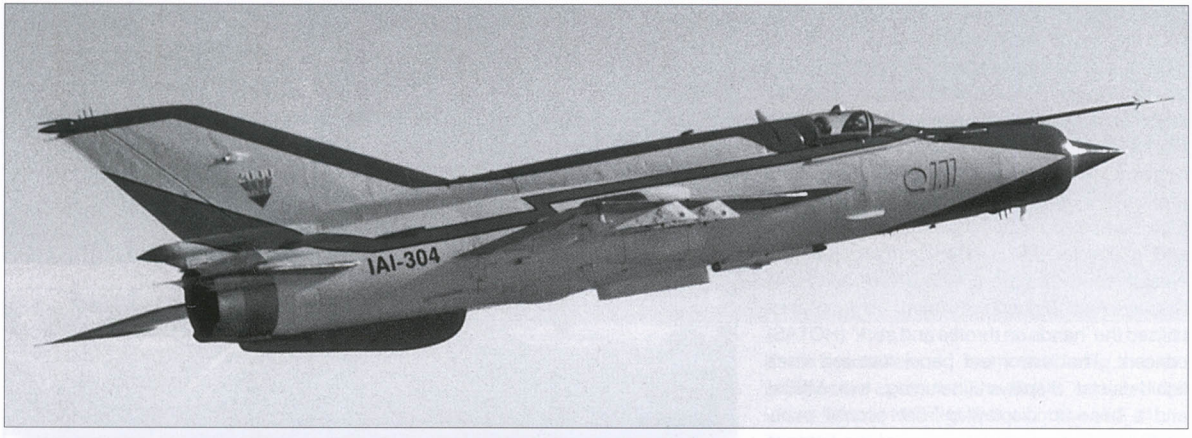

IAI

►▲▲
Another MiG-21-2000 in the IAI conversion facility.

►
The cockpit of the same aircraft representing a more modest upgrade with just one MFD.

►
A MiG-21-2000 with the radome removed, showing the flat-plate scanner of the Elta EL/M-2032 radar.

IAI



IAI

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▲ **IAI-304, another MiG-21-2000 – also converted from a MiG-21*bis* (*izdeliye* 75B). It had the one-piece windshield but no flare dispensers. Note the blade aerial under the nose.**

combat the fighter was armed with four Rafael Python 3 AAMs of Israeli manufacture or other third-/fourth-generation missiles of western provenance. Ground targets could be attacked with laser-guided bombs (three Griffin Mk 82 LGBs or one Mk 84 LGB could be delivered at a time), optically guided weapons or unguided rockets. The 'smart bombs' were to be aimed by means of a Rafael Litening laser designator pod giving round-the-clock capability. The MiG-21-2000 was also able to fly reconnaissance missions with interchangeable reconnaissance pods, including a thermal imaging pod.

The upgrade did not have any major effect on flight performance; the MiG-21-2000 had a normal take-off weight of 8,825 kg (19,455 lb) and a maximum TOW of 10,500 kg (23,150 lb). IAI proposed equipping the fighter with a new 1,300-litre (286 Imp gal) centreline drop tank that would be carried on a suitably modified pylon. Measures intended to enhance flight stability were also proposed in view of the MiG-21-2000's higher all-up weight. Finally, IAI guaranteed product support and aircrew/ground crew training, offering the use of flight simulators and the services of qualified instructors.

The upgrade was unveiled at the 40th Paris Air Show in July 1993 where a Romanian Air Force MiG-21MF ('5902 Black', c/n 96005902) was displayed as a MiG-21-2000 with the exhibit code 252. The aircraft had the EL/M-2032 radar, the curved windshield and a 'glass cockpit' with two MFDs and a HUD/UFCP. It remained in the static park throughout the show, being in non-flying condition. The first flight of the MiG-21-2000 is believed to have taken place in late 1994 or early 1995. In addition to IAI 802 and '5902 Black, there was at least one more demonstrator serialled IAI-304 – a converted MiG-21*bis* (*izdeliye* 75B); it had the curved windshield but lacked IRCM flare dispensers. The cost of the upgrade was assessed as approximately US$ 4 million per aircraft. IAI's Director of Marketing and Product Support said in an interview that the proposed upgrade was equally suitable for the MiG-21MF and the MiG-21*bis*.

In 1995 it was announced that a third MiG-21-2000 configuration had been presented. The aircraft, a Cambodian MiG-21*bis*, had reportedly made its first post-modification flight on 24th May 1995; as compared with the Romanian example displayed at Le Bourget it had a different instrument panel layout. (However – see next entry.)

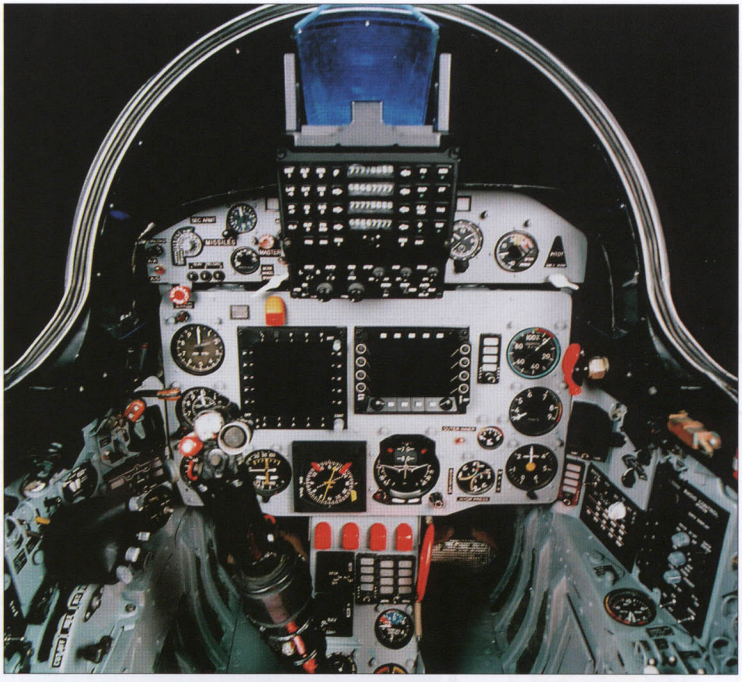
MiG-21-2000 multi-role fighter (Cambodian version)

Nine (some sources say 12) of the Royal Cambodian Air Force's MiG-21*bis* (*izdeliye* 75A) fighters, which had been bought second-hand from the Soviet Union, were to be upgraded to MiG-21-2000 configuration by IAI. In comparison with the configurations shown at Le Bourget these machines represented a more modest upgrade. The Cambodians had insisted that part of the original avionics (first and foremost the RP-22 radar) be retained – primarily for cost reasons. Thus the Israeli avionics had to be integrated with the Russian ones. The Cambodian MiG-21-2000s were to feature revised instrument panels with monochrome LCDs, a satellite navigation system and some other Israeli items.

However, the deal fell through when the USA and The World Bank cut their aid due to political developments in Cambodia. The four Cambodian aircraft that arrived in Israel were presumably never upgraded to MiG-21-2000s.

MiG-21M/MF Lancer A & MiG-21MF Lancer C multi-role fighters

Romania was one of the first MiG-21 operators to launch a mid-life update (MLU) programme. More than 100 MiG-21s of assorted versions were operational with the Romanian Air Force in the early 1990s. Their operation was associated with a good deal of problems – not least due to the collapse of the Warsaw Pact and the Soviet Union, which made spares procurement rather difficult. Also, attrition levels were inordinately high; in 1994 alone the RoAF lost four MiG-21s. Yet, on the one hand, the fighters were still fairly low-time airframes and could serve on for years more, given the proper maintenance; on the other hand, replacing the MiG-21 fleet wholesale would be too costly. Upgrading the fleet was the most sensible option if operational readiness was to be maintained.



Elbit Systems

►▲ **A different MiG-21 cockpit upgrade proposed by Elbit, with two MFDs placed below the HUD/UFCP.**

via RART

► **The same upgrade on MiG-21MF '5902 Black'.**

Robert Ruffle

Robert Ruffle

▲►
MiG-21MF '5902 Black' on display at the 1993 Paris Air Show as a MiG-21-2000 demonstrator with the exhibit code 252.

As mentioned earlier, on 24th May 1993 the Romanian government (represented by Aerostar) signed a deal with IAI and Elbit involving the upgrading of 100 MiG-21M/MF fighters and ten MiG-21UM trainers for the RoAF. Aerostar was to undertake the actual conversion work, while Elbit would supply the new avionics and act as the systems integrator. However, the Romanian upgrade did not materialise in its original MiG-21-2000 form. The programme underwent minor revisions in 1994 (in particular, the total number of aircraft to be upgraded was reduced from 110 to 106) and the upgraded aircraft received the marketing name Lancer.

The first upgraded MiG-21MF entered flight test on 9th May 1996, and the upgrade pro-

gramme went ahead as planned. Later, when the initial order for 106 aircraft had been completed, the RoAF placed a follow-up order for a further four conversions, increasing the total number of Lancers to the original 110; this order was completed on 14th April 2003. The total worth of the two contracts was estimated at US$ 345 million.

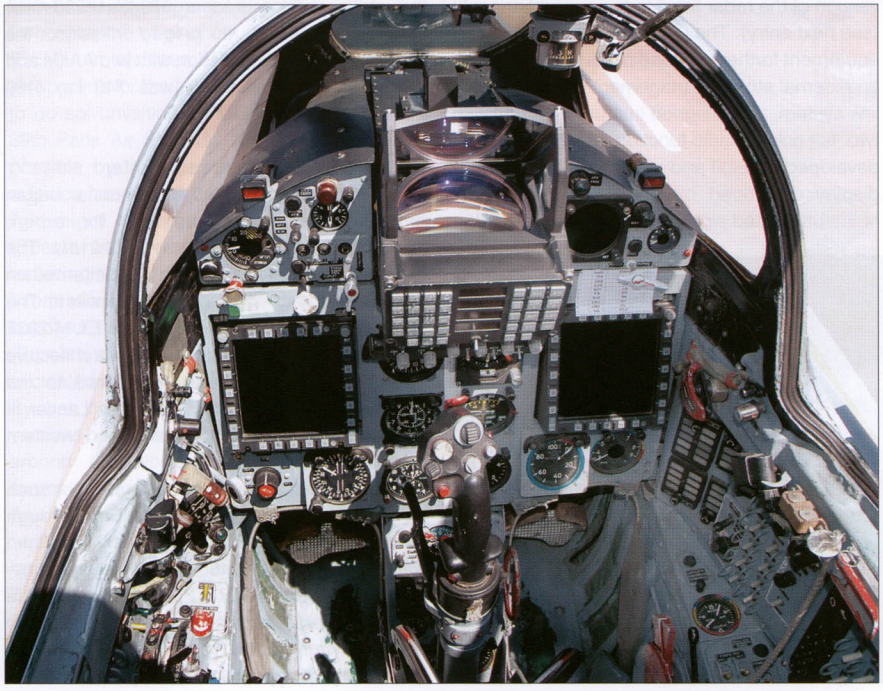
The upgraded aircraft had three distinct versions. 73 of the single-seaters (34 MiG-21Ms and 39 MiG-21MFs) were optimised for strike duties, this version being designated Lancer A; the prototype was '9809 Black' (c/n 969809). A further 26 single-seaters were upgraded as an air defence variant called Lancer C. The prototype ('6607 Black', c/n 96006607; f/n 0517?) first flew on 6th November 1996; the first 'production' upgrade was '6721 Black' (c/n 96006721, f/n

via Internet

▲
A MiG-21M upgraded to Lancer A standard, with ordnance options, including 'smart' bombs.

Yefim Gordon

▲
The badge of the Lancer upgrade programme naming its participants.

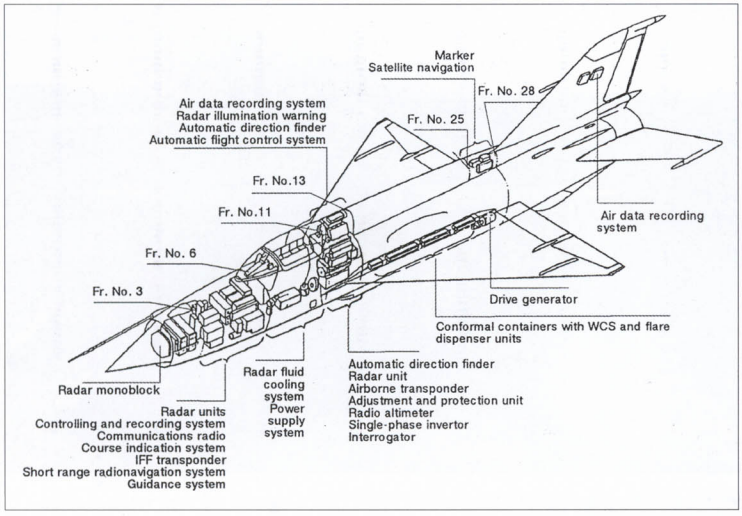


▲◄
MiG-21*bis* '165 Black' became the Lancer III demonstrator and is seen here at Farnborough in 1998. Note the chaff/flare dispenser near the ventral fin.

▲
The logo of Aerostar S.A.

◄
The cockpit of the MiG-21MF Lancer C featuring two MFDs.

Yefim Gordon



▲ **A diagram showing the new equipment items introduced on the Russian MiG-21-93 upgrade.**

SOKOL

▲ **The logo of the Sokol aircraft factory.**

The MiG-21-93 demonstrator is reassembled at Berlin-Schönefeld before the ILA'96 airshow. No overwing chaff/flare dispenser packs are fitted yet. ▼

Sergey Scrynnykov

0521), and the final example ('9611 Black', c/n 969611) was delivered on 16th April 2003. The two versions were readily identifiable by their colour schemes – the Lancer A had green/brown tactical camouflage while the Lancer C had a three-tone grey air superiority scheme. The 14 upgraded MiG-21UM trainers were designated Lancer B (see Chapter 5).

The Lancer A was equipped with an Elta Electronics EL/M-2001B radar, while the Lancer C had the EL/M-2032M radar – an upgraded version of the radar fitted to the export Lancer III (see next entry). The Lancer's new avionics and equipment further included a mission computer, an external stores management system, a data link system, a redesigned instrument panel with two full-colour multi-function displays (MFDs) developed by Elbit and an HUD/UFCP head-up display developed by El-Op, an Elbit DASH helmet-mounted sight and a tactical information presentation system. New communications radios were fitted; the navigation suite included RLG, GPS, distance measuring equipment (DME) and VOR/ILS receivers. The Lancer was provided with a computerised air data system, new IFF transponders, active and passive ECM equipment, and IRCM equipment (chaff/flare dispensers). A health and usage monitoring system (HUMS) was fitted. The Lancer was equipped with an Aerofina ejection seat.

The standard armament of the upgraded aircraft included up to four Rafael Python 3 AAMs, as well as R-60 and R-3S missiles. Provisions were made for carrying the American AIM-9 Sidewinder missile; the pylons were modified to permit carriage of both Russian and western weapons. The Lancer A's air-to-ground weapons included Mk 82 laser-guided bombs equipped with OPHER guidance units. The Romanian contract included the delivery of ten Rafael Litening laser designator pods to be used with laser-guided weapons.

The Lancer A had a take-off weight of 9,400 kg (20,720 lb); the Lancer C was noticeably lighter, grossing at 8,200 kg (18,080 lb) with four Python 3 AAMs. At altitudes above 11,000 m (36,090 ft) the aircraft had a maximum speed of 2,175 km/h (1,351 mph), which equalled Mach 2.05; at low altitude the speed was restricted to 1,300 km/h (807 mph). With four 250-kg (551-lb) bombs and a 490-litre (107.8 Imp gal) drop tank the strike version had a 370-km (230-mile) combat radius on a 'hi-lo-hi' mission; the interceptor's radius of action with two AAMs and three 490-litre drop tanks was 740 km (460 miles).

MiG-21 Lancer III multi-role fighter

As mentioned earlier, IAI and Aerostar began promoting the Lancer upgrade for export, targeting the operators of the MiG-21*bis*. The export upgrade of the *Fishbed-L/N* patterned on the Lancer C was marketed as the Lancer III. The aircraft featured an Elta Electronics EL/M-2032 fire control radar and an open-architecture avionics suite that could be tailored to the customer's requirements. Again, the Lancer III was able to carry both Russian and western weapons.

The first attempts to attract orders for such an upgrade were made at the Farnborough International '96 airshow. The Lancer III was then 'vapourware', to use modern computer slang – that is, it did not yet exist in hardware form. In due course Aerostar obtained a single MiG-21*bis* *Fishbed-L* (c/n 75001012), converting it as the Lancer III prototype; the aircraft made its debut

Yefim Gordon

▲
Aptly coded '21-93 Blue', the MiG-21-93 makes a high-speed pass in full afterburner. The aircraft is wearing its original camouflage scheme.

at Farnborough International '98, serialled '165 Black' and wearing 'Aerostar & Elbit Upgrading House' titles. On 9th (some sources say 6th) October 1998 the Lancer III took off from Bacău on the first flight of a 40-flight test programme, which was performed by Elbit test pilot Yehudi Shafir. The upgrade affected only the fighter's avionics; the proposed modifications for the purpose of extending the R13-300 turbojet's service life were never done.

In 1999 the machine appeared at the 43rd Paris Air Show with the exhibit code 362. Several countries showed an interest in the Lancer III; in particular, Ethiopia intended to order ten such aircraft.

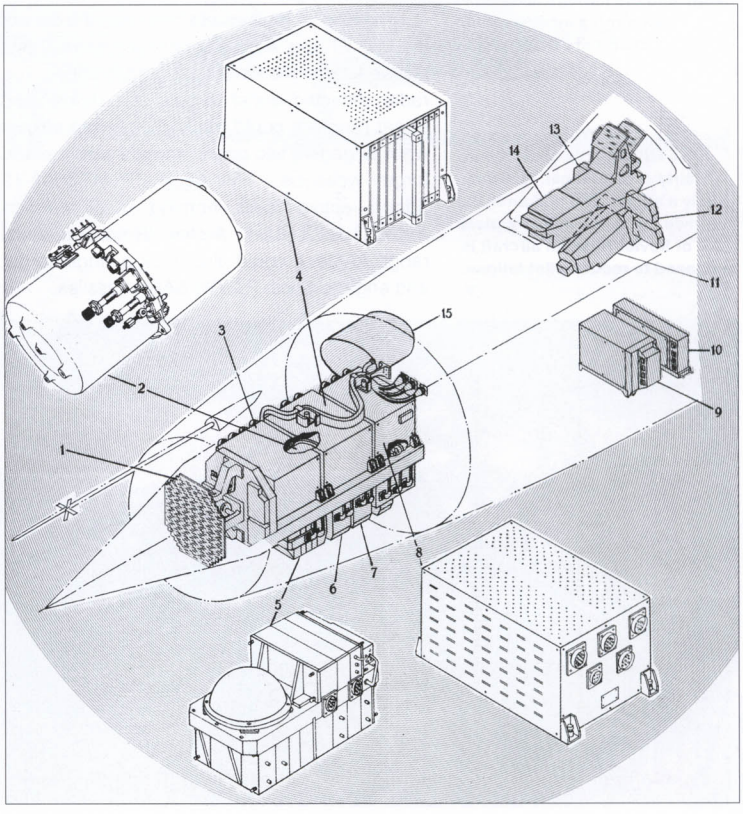
MiG-21-93 development aircraft

Of course, the original equipment manufacturer (OEM) – in this case, Mikoyan – also proposed an upgrade for the MiG-21. In fact, it was the first to do so, unveiling an MLU programme at the 39th Paris Air Show in 1991. This was made possible by the fact that the NPO Phazotron avionics house had developed a compact and lightweight fire control radar named *Kop'**yo*** (Spear) which was an ideal candidate for replacing the MiG-21's existing RP-22 radar. Information on the upgrade programme was supplied to the Rosvo'oruzheniye State Co. (Russia's arms export agency of the time) and circulated to the countries operating the MiG-21. By then more than 6,500 MiG-21s of assorted versions had been delivered to nearly 40 nations around the world; many of the surviving examples were still in good condition and were thus candidates for an upgrade.

The Kop'yo pulse-Doppler slotted-array radar was unveiled at the MosAeroShow '92 in Zhukovskiy in August 1992. By 1993 NPO Phazotron had completed the design documents and built several prototypes of the radar. The company approached the Zhukovskiy-based State Research Institute of Aircraft Systems (GosNII AS – *Gosoo**dar**stvennyy na**ooch**no-is**sled**ovatel'skiy insti**toot** aviatsi**on**nykh sis**tem***), the nation's leading avionics integrator, suggesting that GosNII AS should have a hand in developing the software for the Kop'yo radar, and received a positive response.

Meanwhile, the Mikoyan OKB – by then known as ANPK MiG (*aviatsi**on**nyy na**ooch**no-proiz**vod**stvennyy **kom**pleks* – Aviation Research & Production Complex) – joined forces with NAZ

A diagram showing the location of the weapons control system and data presentation system in the nose of the MiG-21-93.
▼



Yefim Gordon

▲ **'21-93 Blue' performs a barrel roll, showing off the new display colour scheme it gained in 1999.**

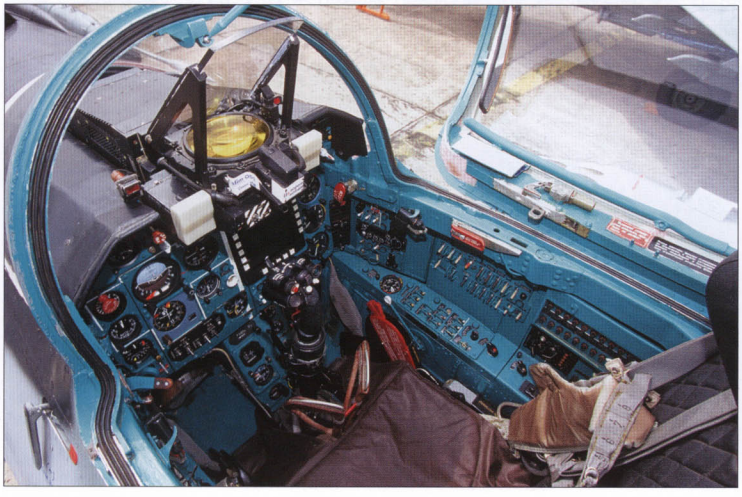
▶ **These views of the MiG-21-93 at Zhukovskiy with dummy R-77 (RVV-AE) and R-73 AAMs show the striking new colours. Note the one-piece windshield and bulged cockpit transparency, the extra AoA sensor fairing on the starboard side of the nose, the RHAWS fairing on the fin leading edge and the fairings above the wing roots incorporating chaff/flare dispensers.**

'Sokol' (the Nizhniy Novgorod aircraft factory, formerly plant No. 21) to develop and implement an upgrade for the MiG-21. The project received the symbolic designation MiG-21-93, making use of the Kop'yo radar and other state-of-the-art avionics and weapons.

Prototype construction was funded by ANPK MiG and NAZ 'Sokol'. Aptly coded '21-93 Blue', the prototype was converted from an early-production MiG-21*bis* with the Polyot-OI ILS (c/n 75001105). The fighter made its public debut at the MAKS-95 airshow in Zhukovskiy on 22nd-27th August 1995.

The Kop'yo multi-mode radar was the core of the MiG-21-93's weapons control system. Tests showed it to have the following capabilities. The radar detected aerial targets and determined target range. It could track up to eight targets while engaging two priority threats with 'fire and forget' weapons – RVV-AE (R-77/NATO AA-12 *Adder*) active radar homing medium-range AAMs or R-73 (AA-11 *Archer*) IR-homing short-range AAMs. It could also track a single target and engage it with R-27R1 SARH missiles.

The MiG-21-93's cockpit was fairly conventional, featuring only a single MFD and an HUD. The vivid turquoise colour typical of Soviet/Russian aircraft is supposed to reduce pilot fatigue. ▼



Sergey Scrynnykov

In a dogfight, the radar had four operating modes. The 'vertical' mode was for attacking targets located straight ahead on the fighter's current heading or close to it (notably during vertical manoeuvres). The 'KAI field of view' mode (KAI = *kolli**mah**tornyy aviatsi**on**nyy indi-**kah**tor* – collimator sight) permitted automatic lock-on against targets lying within a ±14° cone. In 'optical' mode the pilot was able to select the target manually and achieve a lock-on by superimposing the aiming pipper on the target blip on the radarscope. The 'helmet' mode allowed the radar to work in conjunction with an HMS.

In air-to-ground mode the Kop'yo radar permitted ground mapping in actual beam, Doppler beam narrowing (the beam was 10 times narrower) and synthetic aperture modes; in the latter mode the beam was 100 times narrower. The radar map could be 'frozen', allowing the aircraft to follow a pre-programmed route to the target. A maritime mode for use against surface ships was also available, as was the ability to track moving ground targets.

The radar had 'look-down/shoot-down' capability, allowing aerial targets to be tracked and engaged reliably in open airspace, over land or water in head-on and pursuit modes. Among other things, it could engage helicopters in the hover. The radar had a track-while-scan function and allowed visually observable targets to be engaged automatically in a dogfight, using short-range AAMs or cannon fire. The maximum detection range in air-to-air mode was 45 km (27.96 miles), which was 27 km (16.78 miles) longer than that of the RP-22 radar fitted to the MiG-21*bis* – in other words, the detection range was increased by a factor of 2.5! Maritime targets with a high radar signature could be detected at a maximum range of 100 km (62 miles); selected surface targets could then be attacked, using air-to-surface missiles or unguided rockets.

The Kop'yo radar had the following features distinguishing it among other radars:

• in track-while-scan mode (allowing up to eight targets to be tracked while engaging two priority threats) the pilot retained situational awareness and could attack several adversary aircraft at a time, using all four missiles. As the targets entered the area scanned by the radar, the pilot was free to select and engage pairs of priority threats, depending on the situation;

• the radar worked in stealthy mode, which did not allow the adversary aircraft's RHAWS to give the pilot timely warning of an impending attack;

Sergey Scrynnykov

Victor Drushlyakov

Victor Drushlyakov

• the radar had no operating altitude limits (that is, it had 'look-down/shoot-down' capabil-ity);

• thanks to the radar's rapid operation in track-while-scan mode the RVV-AE (R-77) and R-73 AAMs could be used throughout the fighter's operational envelope;

• the continuous tracking mode allowed the fighter to use all types of compatible AAMs (the R-27R1, R-77 and R-73) but was optimised for the former model;

• the radar offered a choice of dogfight modes from which the pilot could choose the one that suited his personal style best;

• the ground mapping mode assisted the pilot at high altitude, in IMC and at night, making it easier to choose the optimum route towards the target, attack it with air-to-surface weapons and return to base;

• the radar boasted high operational reliability;

Three-quarters rear view of the MiG-21-93, showing the RHAWS aerials on the tail and the tandem chaff/flare dispensers. Note the photo calibration markings on the fuselage. ▼

Victor Drushlyakov

• routine maintenance required a minimum of time thanks to the radar's ease of maintenance and the provision of built-in test equipment (BITE).

All of this was made possible by NPO Phazotron's new approach to radar design. During flight tests the Kop'yo radar met the performance target in full, including the ability to attack two priority threats at a time. Importantly, during radar/weapons integration tests involving live missile launches all 12 missiles scored hits – the 'kill' ratio was 100%!

In addition to the new radar, the MiG-21-93 was fitted with the following new equipment items:

• an HMS enabling 'looks-can-kill' attacks of aerial targets within the pilot's eyesight, a data presentation system with two cathode-ray tube (CRT) displays and the KAI collimator gunsight;

• an armament control system;

• an inertial navigation system with satellite correction;

• a digital air data system;

• BVP-60-26 chaff/flare dispensers (blok vybrosa pomekh) in conformal packs above the wing roots with a total of 120 26-mm (1.02-in) cartridges for passive ECM and IRCM;

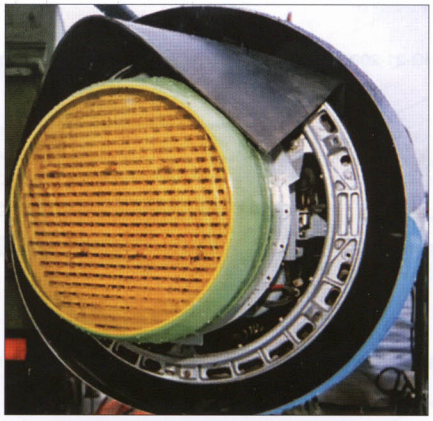
• an automated flight data recording system.

Changes were also made to the electric system and air conditioning system. The dielectric air intake centrebody was replaced with a new one optimised for the Kop'yo radar; the cockpit canopy was also redesigned, featuring a one-piece wraparound windshield and a bulged transparency on the hinged

portion. The cockpit interior was redesigned, featuring a new instrument panel with a single MFD, new control consoles, control stick and throttle lever.

The Kop'yo-21I WCS based on the Kop'yo radar allowed the MiG-21-93 to use the R-73E 'dogfight missile' with an all-aspect seeker head and the R-60M short-range AAM. Medium-range AAMs comprised the R-27R1/R-27T1 (with SARH and IR seeker heads respectively) as carried by the MiG-29 and Su-27 fourth-generation fighters and the RVV-AE (R-77) active radar homing missile. In strike mode the fighter carried the Kh-31A active radar homing anti-shipping missile, the Kh-31P and Kh-25MP anti-radar missiles (ARMs). Other strike weapons included rocket pods with S-5, S-8 and S-13 FFARs, S-24 heavy unguided rockets, free-fall bombs of 100-500 kg (220-1,102 lb) calibre, and KAB-500Kr guided bombs (*korrek**tee**ruyemaya **a**via**bom**ba*).

The upgrade increased the fighter's combat potential sixfold as compared with the original MiG-21*bis*. Russian experts assessed the MiG-21-93's combat efficiency to be several times higher than that of the Romanian Lancer A/C upgrade described earlier. The MiG-21-93 was a true multi-role fighter, approaching the capabilities of such fourth-generation fighters as the Dassault Mirage 2000 and the F-16. Moreover, all export versions from the MiG-21MF onwards could be upgraded to this standard.



◄
Upon completion of the trials the MiG-21-93 was converted into a testbed for the Phazotron Osa phased-array radar. Here the radome is removed, exposing the antenna. The piece of linoleum is placed on top merely to stop the falling snow from getting in.
▼

The MiG-21-93 taxiing at Zhukovskiy.
▼

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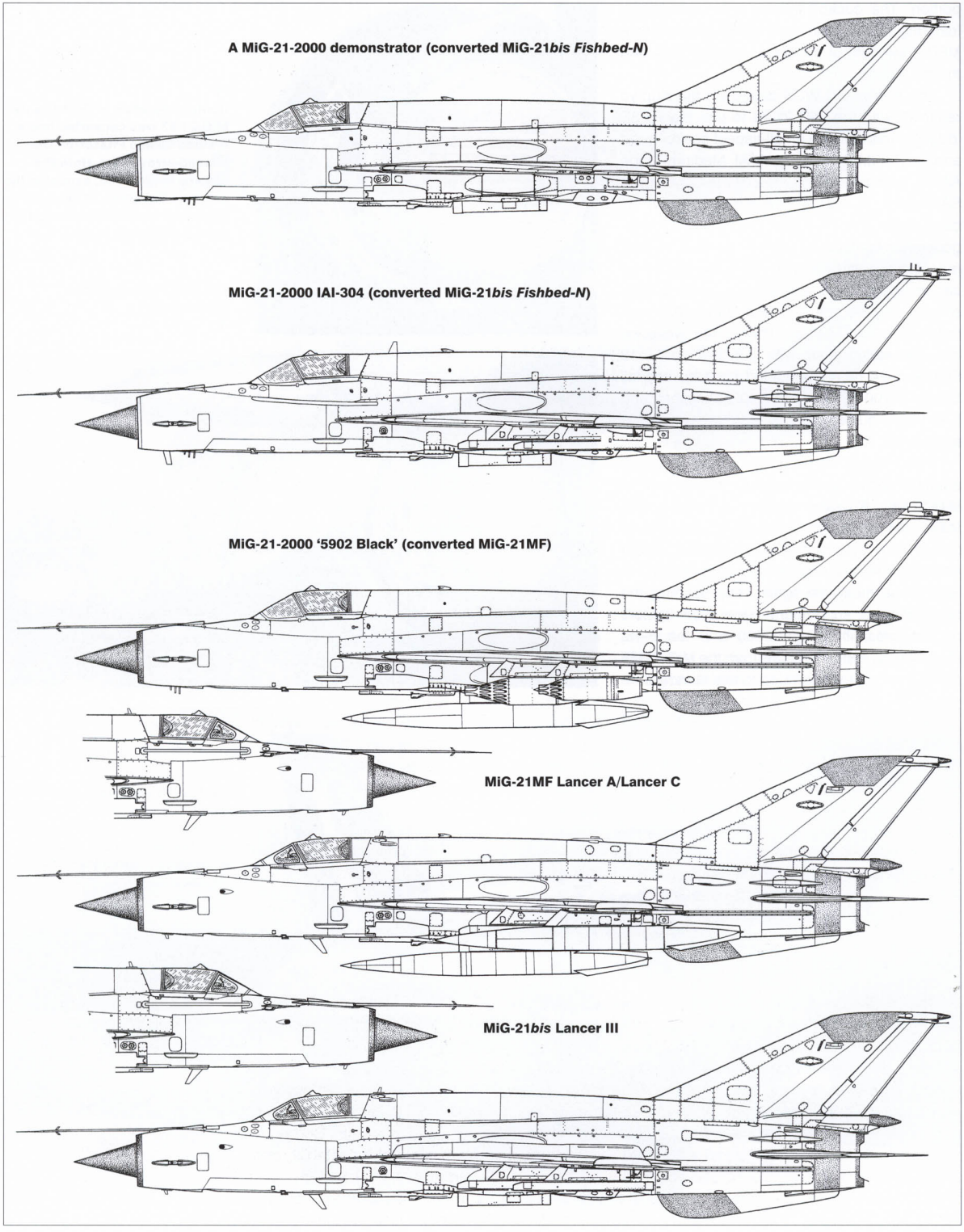
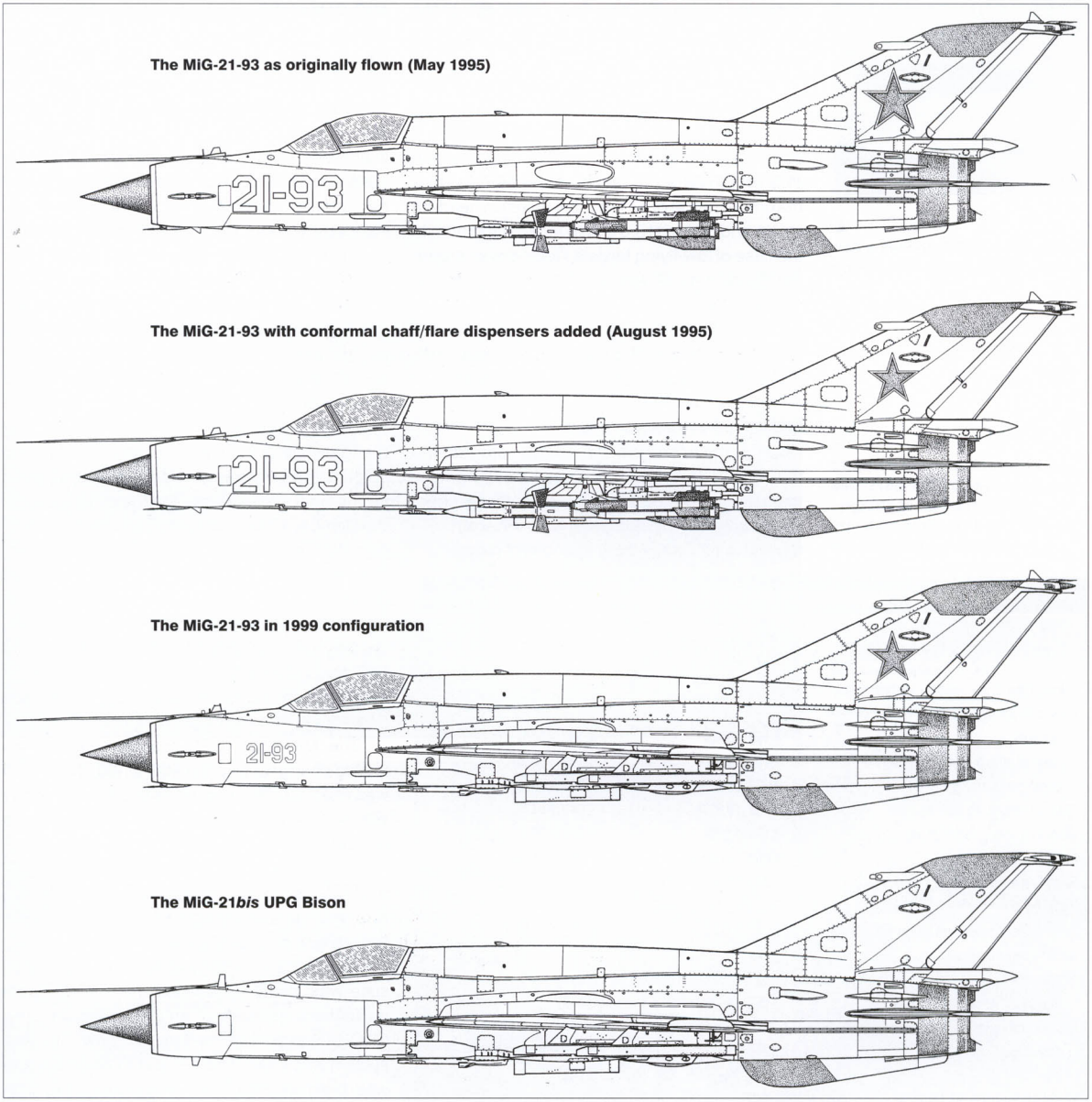

A MiG-21-2000 demonstrator (converted MiG-21bis Fishbed-N)
MiG-21-2000 IAI-304 (converted MiG-21bis Fishbed-N)
MiG-21-2000 '5902 Black' (converted MiG-21MF)
MiG-21MF Lancer A/Lancer C
MiG-21bis Lancer III


The MiG-21-93 as originally flown (May 1995)
21-93
The MiG-21-93 with conformal chaff/flare dispensers added (August 1995)
21-93
The MiG-21-93 in 1999 configuration
21-93
The MiG-21*bis* UPG Bison

For customers who could not afford a 'full option' upgrade, MAPO MiG (*Mos**kov**skoye aviatsi**on**noye proiz**vod**stvennoye obyedi**nen**iye* – Moscow Aircraft Production Association) offered a cheaper limited upgrade package. This was based on the integration of the R-73E all-aspect 'dogfight missile' and the HMS. As part of the limited upgrade, MAPO MiG strongly recommended installing the one-piece windshield offering a better field of view and the chaff/flare dispensers improving the fighter's protection against AAMs and heat-seeking SAMs. The limited upgrade could be performed in the course of refurbishment.

On 25th May 1995 the MiG-21-93 took off from Nizhniy Novgorod-Sormovo (the NAZ 'Sokol' factory airfield) on its 28-minute maiden flight. Factory test pilot Vladimir Gorbunov reported afterwards that the fighter's stability and handling were virtually unaffected by the conversion. This meant that, after familiarising themselves with the new weapons and cockpit

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▲ **A MiG-21bis UPG launches a pair of R-77 (RVV-AE) missiles during trials.**

indication systems, first-line pilots flying the MiG-21*bis* could transition to the MiG-21-93 without any trouble.

The bulk of the testing took place in 1996. The tests confirmed that the Kop'yo radar met the project specifications. In open airspace it could detect a target with a radar cross-section of 5 m² (53.82 sq ft), such as the MiG-21, at a maximum range of 57 km (35.4 miles) in head-on mode and 30 km (18.6 miles) in pursuit mode. In the case of low-flying targets ('look-down' mode) the figure was 57 km and 25 km (15.5 miles) respectively.

The MiG-21-93 made its public debut at the MAKS-95 airshow. Afterwards, '21-93 Blue' took part in many airshows at home and abroad.

MiG-21-93 avionics testbed

Upon completion of the main test programme the MiG-21-93 prototype became an avionics testbed, being used for verifying another product of Phazotron-NIIR (formerly NPO Phazotron) – the compact ***Osa*** (Wasp) fire control radar.

Performance comparison of the MiG-21*bis* and the MiG-21-93

	MiG-21*bis*	MiG-21-93
Engine type	R25-300	R25-300
Engine thrust, kgp (lbst):		
nominal	4,100 (9,040)	4,100 (9,040)
take-off (afterburning)	7,100 (15,650)	7,100 (15,650)
contingency rating	9,900 (21,825)	9,900 (21,825)
Take-off weight, kg (lb)	8,903 (19,627)	9,743 (21,479)
Maximum speed, km/h (mph)	2,175 (1,350)	2,175 (1,350)
Service ceiling, m (ft)	17,500 (57,415)	16,900 (55,460)
Range on internal fuel, km (miles)	1,210 (751)	1,210 (751)
Radar type	RP-22M (Sapfeer-21M)	Kop'yo
Target detection/lock-on range, km (miles)*	14/10 (8.69/6.2)	57/45 (35.4/27.9)
Radar scanning angles:		
azimuth	±30º	±30º
elevation	+15º/–2º	±7º30'
Lock-on zone:		
azimuth	±2º	±30º
elevation	+15º/–2º	±7º30'
No. of tracked/attacked targets	1/1	8/2
Maximum missile launch range, km (miles)	7.6 (4.7)	45 (27.9)
Target flight level, m (ft)	1,000-20,000 (3,280-65,620)	30-22,000 (100-72,180)
'Look-down/shoot-down' capability	no	yes
Helmet-mounted sight	no	yes
Ground mapping mode	no	yes
Anti-radar strike capability	no	yes
Satellite navigation	no	yes
'Go-to' function (route programming)	no	yes
ESM equipment	SPO-10 RHAWS	SPO-10 + 2 x BVP-60-26
Service life extension	–	to 40,000 hours/40 years

* with a radar cross-section of 5 m² (53.82 sq ft)

MiG-21*bis* UPG multi-role fighter (MiG-21I, Bison)

On 3rd May 1998 the Indian Minister of Defence announced that a contract had been signed with MAPO MiG for upgrading more than 100 of the 225 MiG-21*bis* fighters built under licence by HAL. The work had begun back in 1996 when MAPO MiG together with NAZ 'Sokol' had started upgrading 125 Indian Air Force *Fishbed-Ls* under the US$ 428 million contract. The resulting aircraft was designated MiG-21*bis* UPG (for 'upgraded'). The designation MiG-21I (*in**deey**skiy* – Indian, used attributively) was used unofficially but was soon dropped to avoid confusion with the MiG-21I 'Analogue' supersonic transport technology demonstrator (see Chapter 6).

Coded '001 Black' and wearing a striking orange/white/green colour scheme in Indian flag colours, the first prototype MiG-21bis UPG made its first flight from Nizhniy Novgorod-Sormovo on 6th October 1998. This aircraft and the identically painted second prototype ('002 Black') were handed over to the Indian Air Force on 14th December 2000; they arrived in India on 25th December and were commissioned in early January 2001. Meanwhile, by mid-1999 MAPO MiG had completed and delivered a full set of manufacturing documents, allowing HAL to start upgrading the remaining 123 aircraft.

The MiG-21*bis* UPG incorporated the following changes. Like the MiG-21-93, the aircraft was fitted with the Kop'yo radar. A new canopy with a one-piece wraparound windshield and a bulged main transparency giving more headroom was fitted; the cockpit featured an HUD, a new instrument panel with multi-function displays and the Topsight HMS supplied by the French company Sextant Avionique.

The Sextant Avionique Topflight navigation suite was installed; so were the Thales Totem navigation computer, an INS and a new SHORAN/approach system. A new air data system was fitted. The IFF and ECM equipment was borrowed from the indigenous HAL LCA multi-role fighter (Light Combat Aircraft; now called HAL Tejas). A new RHAWS was fitted and integrated with chaff/flare dispensers which, like the former system, were of Israeli origin. The RHAWS antennas were mounted on a small angular fairing projecting beyond the fin leading edge near the top; this fairing, together with the new canopy, was the MiG-21*bis* UPG's external identification feature.

The communications equipment was completely new. The electrics, hydraulics, fuel system, engine controls, air conditioning sys-

tem, windshield de-icing system and radar set cooling system were revised. A French video recording system capturing the attack results and the pilot's actions was fitted. Provisions were made for installing air-to-air and air-to-ground data link systems.

In addition to the GSh-23L cannon the fighter was armed with R-60M and R-73E short-range AAMs, R-27R1 and R-27T1 medium-range AAMs, Kh-25MP ARMs, S-5 and S-8 FFARs and S-24 heavy unguided rockets. It was able to carry free-fall bombs of 100-500 kg (220-1,102 lb) calibre and KAB-500Kr guided bombs.

The first MiG-21*bis* UPG converted by HAL made its first flight in mid-2001. In June 2003 the Indian media wrote that the 72 upgraded aircraft

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◄
Stripped-down Indian Air Force MiG-21*bis* C2770 undergoes an upgrade to MiG-21*bis* UPG standard at the HAL factory in Nasik, Maharashtra. It will be reserialled CU2770 after the conversion, the U standing for 'upgraded'.

MiG-21*bis* UPG CU2816 at an advanced stage of the conversion. Other aircraft are to follow soon.
▼

Simon Watson

(at that time – *Auth.*) were fitted with FK-04 radars; this was a different designation for the Kop'yo radar. By 16th January 2006 94 had been upgraded. In the Indian Air Force the upgraded fighter received the popular name Bison.

MiG-21-98-1 multi-role fighter (project)

In 1998 MAPO MiG developed yet another upgrade – this time for the MiG-21M/MF. Designated MiG-21-98-1, the project envisaged installation of the new cockpit canopy. The fighter was to be equipped with an automatic flight control/man-machine dialogue system and a new *Mos**kit*** (Mosquito) fire control radar. The latter required less electric power than the Kop'yo radar, which meant there was no need to install more powerful generators and hence no changes were required to the engine accessory gearbox. The remainder of the avionics and the armament were similar to those of the MiG-21-93; in particular, the MiG-21-98-1 was able to carry R-73E AAMs. The project has not materialised so far.

MiG-21*bis*D multi-role fighter

In 2002 the Croatian government reportedly began negotiations with RSK MiG concerning the upgrade of the Croatian Air Force's 28 MiG-21*bis* (*izdeliye* 75A) fighters to MiG-21-93 standard. (RSK = *Ros**seey**skaya samo**lyo**tostroi**te**l'naya korpo**rah**tsiya* – Russian Aircraft Corporation; RSK MiG is the company's current name.) However, the negotiations came to naught, if indeed they took place. Instead, in September 2002 Croatia signed a US$ 8.5 million contract with the Romanian company Aerostar for the upgrading of eight MiG-21bis single-seaters and four MiG-21UM trainers to permit NATO interoperability. The first of the upgraded single-seaters, which received the unofficial local designation MiG-21*bis*D (*doradjen* – 'upgraded' in Croatian), flew in March 2003.

The new avionics fitted to the MiG-21*bis*D comprised a Honeywell instrument landing system (VOR/ILS and DME), a GPS receiver, a new IFF system manufactured by Aerostar under licence from Thales, and Rockwell Collins communications equipment. Upgraded aircraft can be identified by the large ventral blade aerial offset to port just aft of the nose gear unit.

These newly acquired aircraft did not give immediate satisfaction and were returned to Aerostar in late 2003 to remedy the faults.

MiG-21*bis* UPG CU2796 at Jamnagar AB with various air-to-ground weapons arrayed in front of it. The aircraft is almost identical in appearance to the MiG-21-93. Note the cannon ammunition belts arranged in such a way as to indicate the owner of this particular aircraft, the Indian Air Force's 32 Squadron 'Thunderbirds'. ▼

Simon Watson

PART FIVE

THE TRAINERS

RSK MiG

RSK MiG

▲ **'61 Red', the first prototype MiG-21U conversion trainer (Ye-6U/1).**

Ye-6U fighter trainer prototypes

In the early 1960s the obsolete UTI MiG-15 *Midget* was still the principal conversion and proficiency trainer used by the Soviet Air Force's flying schools and first-line units. Although easy to fly and characterised by safe handling, the subsonic UTI MiG-15 could not match the performance of the supersonic MiG-21F, which severely complicated the transition to fast jets. Therefore, as soon as the MiG-21F entered production the design staff of OKB-155 set about developing a trainer version of the fighter offering comparable performance. The two-seater received the manufacturer's designation Ye-6U, the U standing for *oo**cheb**nyy* [*samo**lyot***] – trainer.

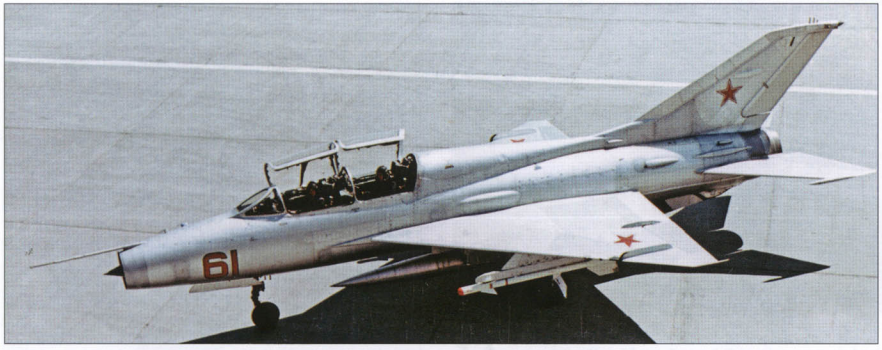
Development of the Ye-6U was officially sanctioned by a Council of Ministers directive issued on 11th November 1959. This required the trainer to have a maximum speed of 2,000-2,200 km/h (1,242-1,367 mph), a service ceiling of 20,000 m (65,620 ft) and a range of 1,400 km (870 miles) on internal fuel. The take-off run with two K-13 AAMs was not to exceed 700 m (2,300 ft), while the landing run was to be no more than 600 m (1,970 ft) with a brake parachute or 1,200 m (3,940 ft) without it.

The Ye-6U trainer was derived from the Ye-6T tactical fighter; except for the cockpit section and the trainer's dorsally mounted pitot boom, the two were virtually identical; in particular, the narrow-chord vertical tail with the small root fillet was the same. The forward fuselage structure was revised up to and including fuselage frame 18 in order to accommodate a second cockpit for the instructor. The tandem cockpits were enclosed by a common three-piece canopy comprising a fixed windshield with triangular sidelights and individual hinged portions opening manually to starboard; a glazed partition separated the trainee from the instructor. The shape of the fuselage spine was revised accordingly. Like the Ye-6T, the two-seater featured an automatic system controlling the air intake shock cone and a KAP-1 autopilot serving the roll channel only. It was powered by the same R11F-300 engine and the cockpits were equipped with the same SK ejection seats, although these no longer used the canopy as a slipstream shield. The fuel capacity was increased to 2,350 litres (517 Imp gal), which equated to a fuel load of 1,950 kg (4,300 lb).

Due to weight restrictions the single NR-30 cannon had to be replaced with a 12.7-mm (.50 calibre) Afanas'yev A-12,7 machine-gun with 60 rounds in a removable conformal pod. In addition to K-13 missiles on APU-13 launch rails, the trainer could carry bombs or UB-16-57U rocket pods with 57-mm FFARs. The *sparka* was fitted with new KT-92 mainwheels featuring disc brakes of increased diameter. (***Spar**ka* is a Russian colloquial word meaning 'a pair of something'; in aviation slang it denotes a two-seat trainer, referring to the dual controls (***spa**rennoye oopravl**eni**ye*). Thus it translates loosely as 'two-sticks'.)

Designated Ye-6U/1 and aptly coded '61 Red', the first trainer prototype entered manufacturer's flight tests in the autumn of 1960; the maiden flight took place on 17th October with Pyotr M. Ostapenko at the controls. In February 1961 the aircraft was turned over to GK NII VVS for joint State acceptance trials which began on 28th March. The trainer was flown by military test pilots Vladimir S. Seryogin (who was killed in a flying accident together with the world's first spaceman Yuriy A. Gagarin on 27th March 1968) and N. I. Divooyev; V. P. Yoodin was engineer in charge. Yet barely a month later the trials were suspended and the aircraft was returned to the manufacturer due to various deficiencies, poor longitudinal stability being the most serious one.

Coded '62 Red', the second prototype (Ye-6U/2) joined the first machine in the State acceptance trials programme after a brief series of initial flight tests. This aircraft had a 210-litre (46.2 Imp gal) increase in fuel capacity bringing total internal fuel up to 2,340 litres (514.8 Imp gal); other changes included the addition of an SOD-57 decimetre-waveband ATC transponder



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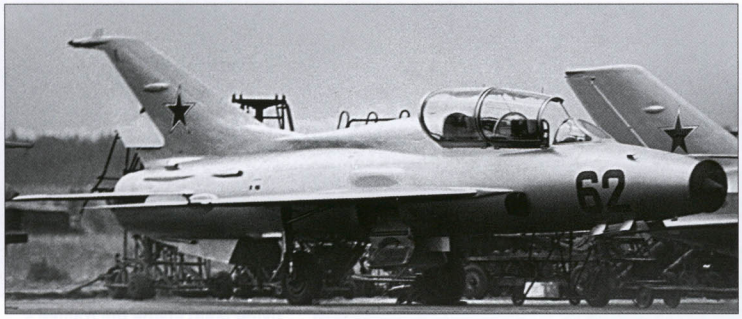
The Ye-6U/1 with the canopies open and two R-3S missiles under the wings. The shape of the fuselage spine is clearly visible. Note the folded blind flying hood inside the trainee's canopy.

◄
Here the first prototype is seen with photo calibration markings applied to the forward and rear fuselage and the fin.

Two more views of the Ye-6U/1. The longer wheelbase as compared with the single-seater is evident.
▼

RSK MiG

RSK MiG



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▲ ►

'62 Red', the second prototype MiG-21U (Ye-6U/2), on the ground and in flight.

These views of the Ye-6/2 show the AoA sensor fairing on the port side of the nose.

▼

The Ye-6U/4 ('64 Red') flies chase for the Su-9U-LL ejection seat testbed ('10 Red').

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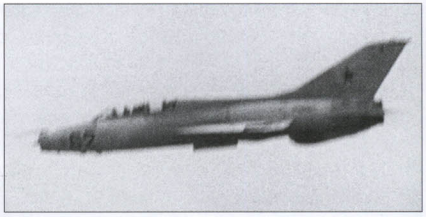
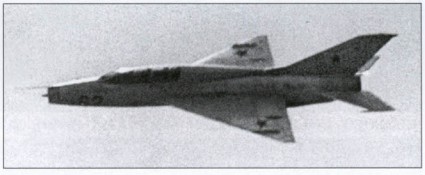


Boris Vdovenko



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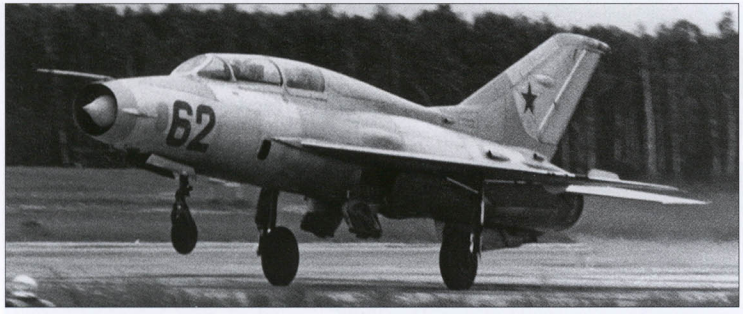

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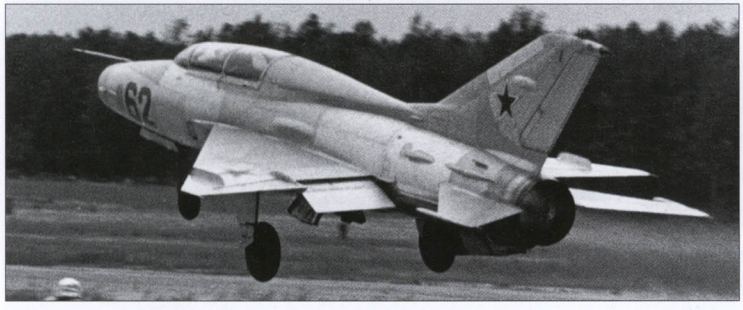

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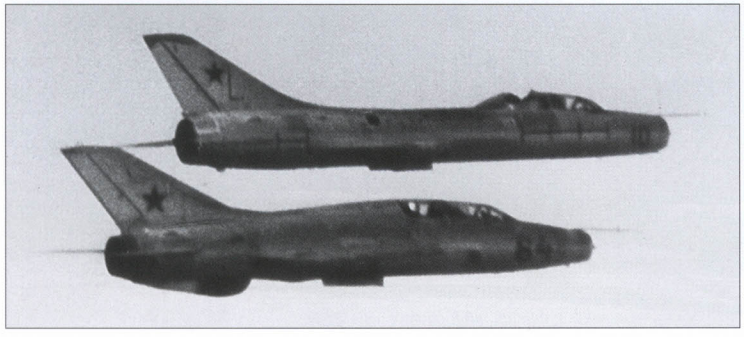


Yefim Gordon archive

and an automatic device adjusting the operation of the KAP-2 autopilot to suit the current altitude and speed. The Ye-6U/2 had a PT-21 brake parachute stowed in a ventral bay between frames 30-32.

The detachable machine-gun pod, which had been modified after the initial round of tests, underwent State acceptance trials on the Ye-6U/2 between 17th February and 15th June 1961. The results proved encouraging and the machine-gun pod was recommended for air-to-ground and air-to-air gunnery practice. The second prototype was flown by test pilots A. A. Manucharov and G. A. Gorovoy, with B. P. Sevodnyayev as engineer in charge. In order to keep the CG within acceptable limits and improve the trainer's longitudinal stability margin, 40 kg (88 lb) of ballast were installed in the extreme nose at frame 2 (just aft of the shock cone). In addition to exploring the trainer's flight envelope and checking the aircraft's stability and handling, the test pilots made two flights on a dirt airstrip.

In August 1961 the Soviet Air Force Commander-in-Chief endorsed the State acceptance trials protocol giving a positive appraisal of the Ye-6U trainer and recommending it for production. The protocol said that the two-seater was virtually identical to the single-seat MiG-21F-13 as regards stability, handling and manoeuvrability. It also pointed out certain deficiencies of the Ye-6U. One of these was the tendency to increase the angle of attack spontaneously after landing gear retraction during a take-off at full military power, a tendency easily neutralised by gentle forward stick motion; the phenomenon was not encountered during afterburner take-offs. Another weakness – one which the Ye-6U shared with the single-seater – was the high rudder pedal forces at speeds in excess of Mach 1.4. One more deficiency was

that, while the aforementioned ballast in the nose did improve the longitudinal stability margin, it also altered the aircraft's directional stability characteristics, causing a tendency to side-slip at certain speeds; this also impaired the trainer's acceleration and increased the fuel burn.

The State commission that signed the protocol recommended that the Ye-6U be fitted with new SK-3 ejection seats, a KAP-3 bank-only autopilot and the boundary layer control system, once the latter feature had been verified on the single-seat fighter.

In 1962-63 the Mikoyan OKB and GK NII VVS held a special spin test programme with the Ye-6U at Zhukovskiy; at this stage the aircraft was flown by Aleksandr V. Fedotov, Aleksandr A. Shcherbakov, V. G. Plyushkin and other OKB and LII test pilots. Unfortunately the trainer's spinning behaviour turned out to be different from that of the MiG-21F – unlike the single-seat fighter, the Ye-6U would not perform a single stable spin. In other words, the trainer was spin-proof while the single-seat version was not, which complicated the training of pilots in spin recovery techniques.

The Ye-6U/2 was one of the Mikoyan aircraft participating in the grand airshow at Moscow-Domodedovo on 9th July 1967.

MiG-21U conversion/proficiency trainer (*izdeliye* 66, *izdeliye* 66-400; *Mongol-A*)

In 1962 the Tbilisi aircraft factory No. 31 manufactured the first three production examples of the Ye-6U, which in its production form received the service designation MiG-21U. The trainer's product code was *izdeliye* 66. That same year the trainer entered production at MMZ No. 30 'Znamya Truda' as well, remaining in production there until 1966; Moscow-built examples were intended for export only. Later the Tbilisi plant became the principal manufacturer of the MiG-21's two-seat versions.

Two construction number systems were used. Moscow-built examples had six-digit c/ns – for instance, Finnish Air Force MK-103 (c/n 661416), which means *izdeliye* 66, Batch 14, 16th aircraft in the batch. Tbilisi-built aircraft had eight-digit numbers – for example, 07665106 (that is, 07th example of *izdeliye* 66, plant No. 31, Batch 06); the plant number was replaced by a code, 51, to throw hypothetical spies off track.

The MiG-21U's fuel system included six fuselage tanks; the No. 1 tank was a strap-on metal tank (saddle tank) forming the fuselage spine, while the other five were bladder tanks located inside the fuselage between frames 14-28. The No. 3 tank was split into upper and lower portions, while the Nos. 5 and 6 tanks consisted of port and starboard halves. Furthermore, the wings incorporated four integral tanks; the centreline pylon was plumbed for carrying a standard 490-litre (107.8 Imp gal) drop tank which could be jettisoned by either crew-member.

via Internet

▲
A camouflaged MiG-21U (*izdeliye* 66-400). The unpainted canopy of the rear cockpit appears to be a replacement item.

The MiG-21U's basic avionics included an RSIU-5 VHF radio, an ARK-10 ADF, an MRP-56P marker beacon receiver, an SOD-57 ATC transponder and an SRO-2 Khrom IFF transponder or SRZO-2 Khrom-Nikel' IFF interrogator/transponder. The aircraft was equipped with a KAP-2 bank-only autopilot and fitted with the machine-gun pod which, in its production form, was designated GP-A-12,7 (*gon**dol**a podves**na**ya* [*s poole**myo**tom*] A-12,7 – 'suspended pod with A-12,7 machine-gun').

Starting with Batch 7 (that is, from c/n 01665107 onwards), the 500 x 180 mm (19.68 x 7.08 in) KT-38 nosewheel with twin expander-tube brakes was replaced by an identically sized KT-102 wheel with a more effective disc brake; some sources say the modification was introduced in Batch 9 (from c/n 01665109 onwards). From c/n 07665106 (the last example with the original narrow-chord vertical tail) onwards the original; area-increasing flaps were replaced by simple hinged flaps whose axles were attached to wing ribs 1 and 6; appropriate

A Soviet Air Force MiG-21U (*izdeliye* 66-600) shows off the wide-chord tail and a brake parachute container at the base of the rudder. Note the red-painted nose gear doors and the repetition of the tactical code on the fin. The dielectric insert in the latter was probably added during an overhaul.
▼

via Internet

L+K

L+K

via RART

changes were made to the hydraulic system. The flaps had a maximum deflection of 25°.

In keeping with the then-current practice the trainer version of the MiG-21 (*Fishbed*) received a totally different reporting name, *Mongol*, in the 'M for miscellaneous' category. Later, when upgraded versions of the trainer were identified by the West, the reporting name of the original MiG-21U was amended to *Mongol-A*.

The MiG-21U's production run at plant No. 31 totalled 180 aircraft; the last Tbilisi-built example was completed in 1970. The export version of the MiG-21U with the original narrow-chord tail (*izdeliye* 66) was designated *izdeliye* 66-400. The export version of the narrow-tailed MiG-21U had a separate product code, *izdeliye* 66-400 (hence the erroneous designation 'MiG-21U-400' which is encountered in some Western publications); it differed from the domestic model in avionics and equipment. As mentioned above, the export model was produced by MMZ No. 30 in 1964-68, deliveries of the MiG-21U (*izdeliye* 66-400) being made to East Germany, Czechoslovakia, India and other 'friendly nations'.

The Indian Air Force's MiG-21U operations are a good example of how the *sparka* was used for pilot training. Initially the IAF took delivery of the MiG-21U (*izdeliye* 66-400) in sufficient numbers for each MiG-21 squadron to have two of the trainers. The pilots took their first steps in the conversion training course in special training units, starting off by studying the Soviet aircraft's design and performance. The next step was a ten-hour course on a flight simulator; then the trainees moved on to the actual aircraft, making four flights in the MiG-21U. The final step was a ten-hour solo training course on the single-seat MiG-21FL fighter. The MiG-21U was also used for blind flying training and aerobatic training.

MiG-21U conversion/proficiency trainer (*izdeliye* 66-600; *Mongol-B*)

From c/n 08665106 onwards the MiG-21U was built with a new wide-chord vertical tail patterned on that of the late-production MiG-21PFS and MiG-21PFM; vertical tail area was increased from 4.43 m² (47.68 sq ft) to 5.32 m² (57.26 sq ft). Concurrently the PT-21 brake parachute stowed beneath the engine jetpipe gave place to the

▲▲◀
A VS-2 ejection seat is installed into the rear cockpit of MiG-21U (*izdeliye* 66-400) OK-016 – the Czech ejection seat testbed operated by VZLÚ.

◀▲
These views give a comparison of the old and new colour schemes worn by MiG-21U OK-016.

Martin Novak

larger PT-21U parachute housed in a cylindrical fairing at the base of the rudder, just like on the late-production MiG-21PFS and MiG-21PFM.

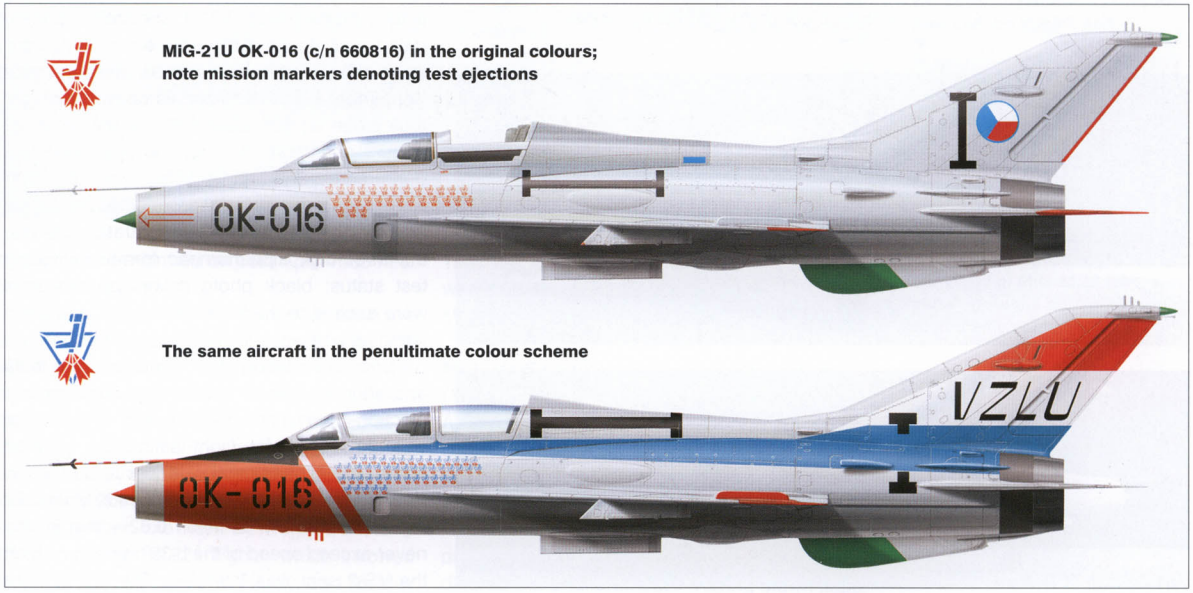
Designated *izdeliye* 66-600, the broad-tailed version of the MiG-21U was outwardly similar to the later trainer versions but was powered by the old R11F-300 engine and lacked the boundary layer control system. It could be identified by the all-metal fin and the lack of a forward vision periscope on the instructor's cockpit canopy. The NATO reporting name was *Mongol-B*.

Martin Novak

▲▲
The same aircraft at Prague-Kbely with its original Czechoslovak AF serial, 0816 Black.
▲
MiG-21U OK-016 taxies during an air event.

MiG-21U-OP chase aircraft (Ye-6U-OP)

A single production MiG-21U (the c/n has been reported as 3116, suggesting this is a Moscow-


MiG-21U OK-016 (c/n 660816) in the original colours;
note mission markers denoting test ejections
OK-016
The same aircraft in the penultimate colour scheme
VZLU
OK-016

Yefim Gordon archive

▲ **Pilot Lydia Zaïtseva, who set an altitude record in a specially modified MiG-21U known as the Ye-33 in June 1965.**

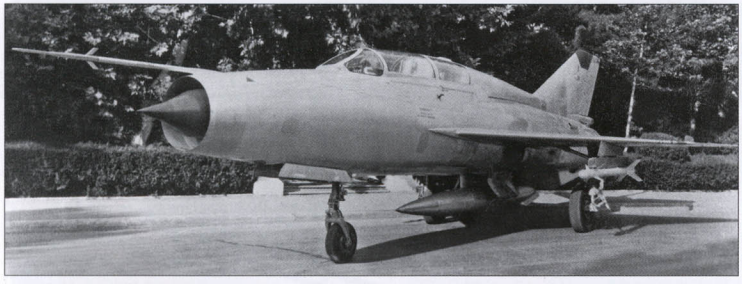
built example and the full c/n is 663116) was specially modified as a chase plane and camera platform to meet a request from GNIKI VVS. It was intended for filming missile or rocket launches, external stores drops (including the jettisoning of drop tanks and the emergency jettisoning of pylons with or without weapons), as well as cockpit canopy jettison tests performed by other aircraft and other aerial filming or observation work. The machine was designated MiG-21U-OP or Ye-6U-OP, the OP suffix probably standing for *oper**ah**torskiy* [*samo**lyot***] – '[camera] operator's aircraft' or camera platform.

The Air Force drew up specifications for the conversion which were endorsed on 5th August 1966. The conversion proceeded in accordance with these specs and the manufacturing documents prepared by OKB-155; however, it was not the Mikoyan OKB's own experimental plant but the prototype construction facility of OKB-23 headed by Vladimir Mikhaïlovich Myasishchev that performed the actual work. To facilitate the cameraman's work the rear cockpit was stripped of equipment – the instrument panel, side console and control stick were removed and the rudder pedals were replaced by footrests. This allowed an AKS-2 ciné-camera to be installed; stowage was provided for an extra film cassette.

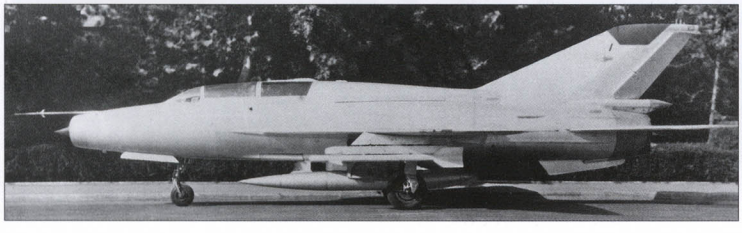
The MiG-21U-OP (Ye-6U-OP) was formally taken on charge by GNIKI VVS on 4th October 1968. The chase plane allowed aerial filming sorties to be flown at supersonic speeds. There is photo evidence that the aircraft was coded '64' (the colour of the code is not known).

The Ye-6US (MiG-21US) prototype. Note the forward-vision periscope on the rear canopy. The prototype lacked the AoA sensor on the nose. ▼

RSK MiG



RSK MiG



MiG-21U ejection seat testbed

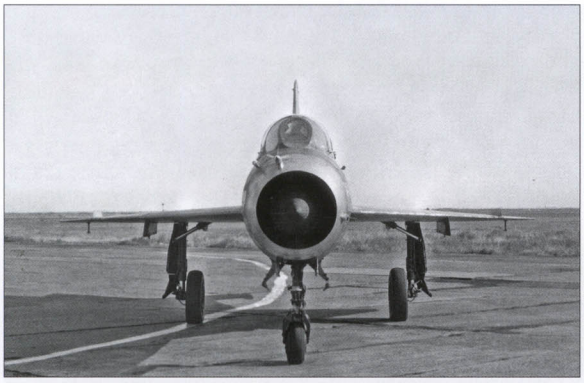
In late 1981 the Flight Test and Development Unit in Prague (VZLÚ – *Výzkumní a zkušební letecký útvar*), the Czechoslovak equivalent of LII, had a requirement for a fast jet that could be used for testing the indigenous VS-2 ejection seat (*vystřelovací sedačka* – ejection seat). This seat developed for the Aero L-39 Albatros advanced trainer (and subsequently fitted to its derivatives – the L-59 trainer and the L-159 ALCA advanced light combat aircraft) had passed initial testing at lower speeds on another VZLÚ testbed – a suitably modified Avia CS-102 (licence-built UTI MiG-15) registered OK-010 (c/n 822210). However, the latter aircraft was too slow for the seat's operational envelope to be explored fully.

Hence the Czechoslovak Air Force agreed to transfer one of its MiG-21U (*izdeliye* 66-400) trainers to VZLÚ for conversion into an ejection seat testbed. The aircraft in question, 0816 Black (c/n 660816), had seen service with the CzAF's 1st Flight Training Regiment at Přerov.

On 23rd November 1981 the decommissioned aircraft arrived at Prague-Kbely for examination and conversion and was taken on charge by VZLÚ's flight test facility. The conversion involved stripping out the rear cockpit, which was to house the experimental seat. The rear cockpit had a metal fairing with low-cut sides fitted instead of the usual hinged canopy, which could be reinstalled for positioning flights. The design work was performed by engineer Mašek.

The co-located military aircraft repair plant (LOK – Letecké Opravny Kbely) undertook the actual modification. VZLÚ specialists participated in all stages of the work, which turned out to be rather lengthy and was completed in mid-September 1982. The first post-conversion flight took place on 30th September at the hands of VZLÚ's chief test pilot Přádný. The machine's performance and handling was checked in that flight. Originally the testbed retained its overall silver finish but wore the civil registration OK-016, the three-digit alphanumeric format indicating test status; black photo calibration markings were applied to the fuselage and tail, and a red lightning bolt was painted on the nose.

Upon completion of the manufacturer's tests and after a series of remote-controlled ground ejections from a stationary aircraft, a technique was developed for flight-testing the ejection seats. The experimental seat was to be fired in level flight at speeds ranging from 360 km/h (223 mph; 194 kts) IAS to Mach 0.82 – that is, the never-exceed speed of the L-39 trainer for which the VS-2 seat was intended. The first in-flight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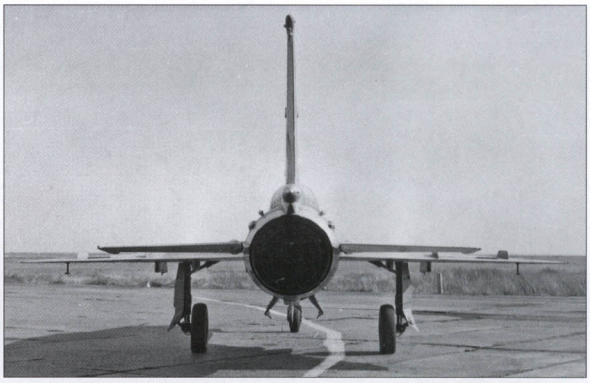
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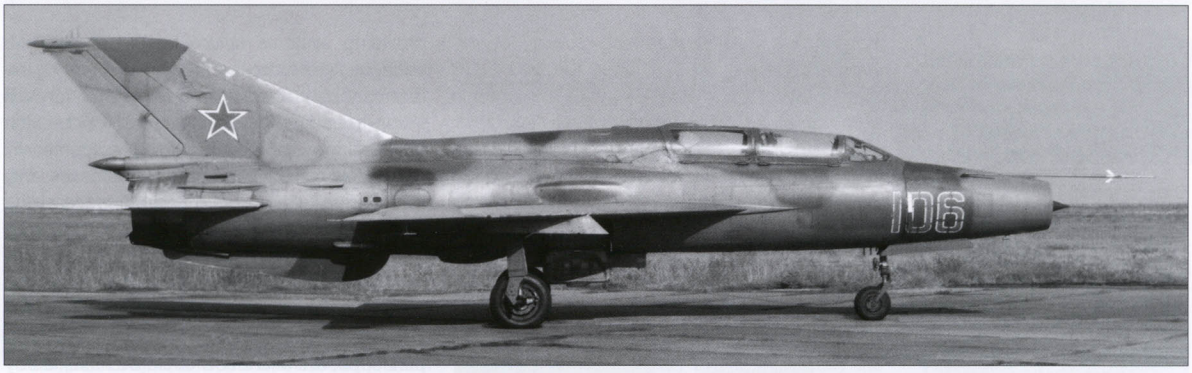

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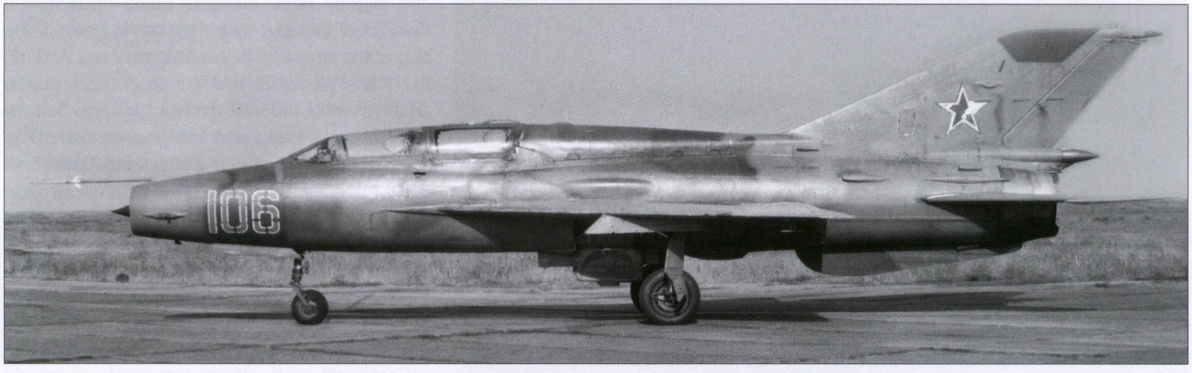

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▲
Four views of MiG-21US '106 Yellow'. Note the AoA sensor on the port side of the nose.

ejection was performed on 15th April 1983 near Sazená airfield.

In due course OK-016 gained an attractive silver/red/white/blue special colour scheme with VZLÚ tail titles after refurbishment by LOK; numerous mission markers were applied below the cockpit to mark successful test ejections. In the early 1990s the machine reverted to its original military identity, 0816 Black, but retained the same stylish colour scheme.

In its testbed role the aircraft logged a total of 120 hrs 24 min in 224 flights, which involved more than 50 test ejections. Finally, on 17th May 1997 the MiG-21U made its last flight to Kbely, where it was decommissioned and put in storage; in 2004 it was up for sale.

MiG-21US conversion/proficiency trainer (Ye-6US, *izdeliye* 68; *Mongol-B*)

As the fighter versions of the MiG-21 evolved, so did the trainer. In 1966 the Tbillisi aircraft factory launched production of an improved derivative of the MiG-21U (*izdeliye* 66-600). Designated MiG-21US (or Ye-6US) and bearing the in-house product code *izdeliye* 68, the new version differed first and foremost in having blown flaps,

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▲ **MiG-21US '62 White outline' operated by LII takes off from a special ski jump at Zhukovskiy, demonstrating a short take-off technique developed for tactical airstrips.**

via RART

▲ **This MiG-21US was operated by VZLÚ, wearing the registration OK-004 in low-visibility form.**

hence the S suffix denoting *sdoov* [*pogra-**nich**novo **sloy**a*] (BLC). Hence the MiG-21US was powered by the R11F2S-300 engine featuring bleed valves for the BLC system.

Another important change concerned the crew escape system: the MiG-21US was equipped with two different versions of the more capable KM-1 ejection seat – a KM-1U in the front cockpit (the U stands for *ooche**nik*** – trainee) and a KM-1I in the rear cockpit (the I stands for *in**strook**tor* – instructor). The rear cockpit featured a larger bank of switches allowing the instructor to make life sour for the trainee by providing systems failure inputs. In order to enhance flight safety on take-off and landing the rear canopy incorporated a retractable forward vision periscope which retracted together with the landing gear and popped up automatically during gear extension. However, this necessarily involved installing a large opaque insert at the top of the canopy, so the instructor's overall field of view was actually somewhat reduced.

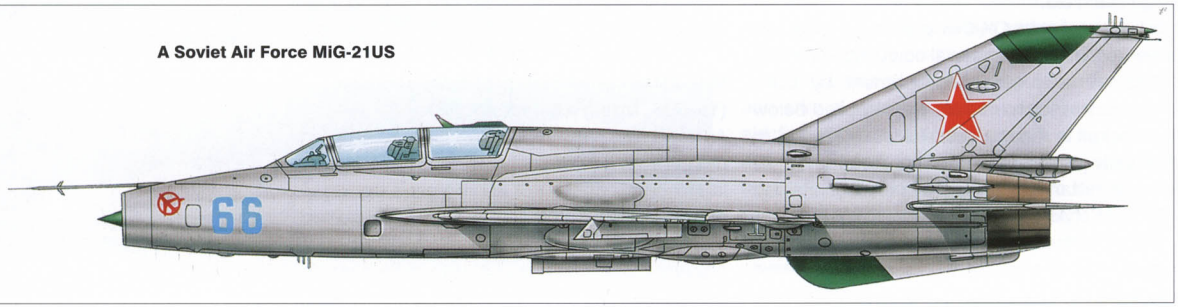
The internal fuel capacity was increased to 2,450 litres (539 Imp gal), which equals a fuel load of 2,030 kg (4,475 lb). Apart from the periscope, the MiG-21US could be identified by the slightly fatter fuselage spine housing the additional fuel and by the dielectric insert at the top of the fin enclosing radio antennas.

The MiG-21US was in production at the Tbilisi plant in 1966-70; a total of 347 was built for the Soviet Air Force and foreign customers. The c/n system was the same as for Tbilisi-built MiG-21Us, except for the different product code (for example, '106 Yellow', c/n 04685127). The NATO reporting name was *Mongol-B*.

MiG-21US export version (Ye-6US, *izdeliye* 68A; *Mongol-B*)

MiG-21US trainers destined for export had a slightly different avionics fit and a revised product code, *izdeliye* 68A.

A Soviet Air Force MiG-21US



Ye-33 record-breaking aircraft

The high performance of the Ye-6U trainer, which matched the single-seat MiG-21F-13 almost completely in terms of speed and handling, allowed two Soviet female pilots to set two world records. The aircraft in question, which featured in the official FAI documents under the bogus designation Ye-33, was specially lightened by removing all surplus equipment items.

On 22nd May 1965 N. A. Prokhanova reached an altitude of 24,336 m (79,842 ft) in a zoom climb; no woman had ever flown so high before. A month later Lydia Zaïtseva set another altitude record, attaining 19,020 m (62,401 ft) in sustained level flight.

MiG-21US testbed

In 1970-75 LII used a specially modified MiG-21US (the c/n was quoted as 1214 – that is, 12685114?) for, as one source cunningly put it, 'researching the interaction between the pilot and the aircraft in abnormal flight situations and for testing on-board safety systems'. This flowery phrase could refer to tests of active flight safety systems, such as a 'panic button' bringing the aircraft into straight and level flight from any attitude, should the pilot become disoriented. However, it could just as easily mean tests of ejection seats and canopy jettison systems.

No details are known. However, it is known that LII's extensive fleet of miscellaneous test and research aircraft included a MiG-21US coded '68' (c/n 09685126); the colour of the code was either red or blue. This could well be the aircraft in question. The machine had a small cylindrical fairing with a hemispherical front end at the top of the fin housing a forward-looking ciné-camera; another camera pointing obliquely aft was accommodated in the bulged front end of a semi-cylindrical fairing on the starboard side of the centre fuselage. This suggests that '68' was indeed used for canopy jettison system or ejection seat trials. Later the tactical code was changed to a low-visibility version as '68 White outline'.

By 2002 MiG-21US '68 White outline' had been placed in storage at Zhukovskiy. By then the camera fairing at the top of the fin had been removed and the normal fin tip had been reinstated; the lateral camera fairing remained, however. Subsequently the aircraft was preserved as a gate guard in front of the Test Pilots School (ShLI – ***Shko****la* ***lyot****chikov-ispy****tah****teley*) on the north side of the LII airfield in Zhukovskiy.

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MiG-21US development aircraft

Some sources claim that a single Czechoslovak Air Force MiG-21US serialled 0241 Black (c/n 02685141) was converted into an ejection seat testbed by VZLÚ (similar to OK-016 described above) and registered OK-004. Other sources, however, do not confirm this – apparently the

▲
This Soviet MiG-21US coded '66 Blue' wears an unusual badge – a stylised aircraft in a winged circle. The inside of the rear canopy incorporating the periscope is visible in the lower photo.
▼

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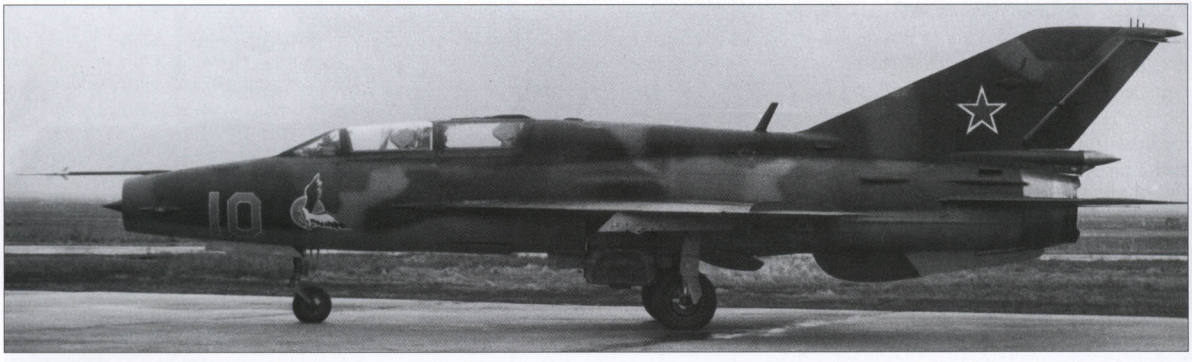

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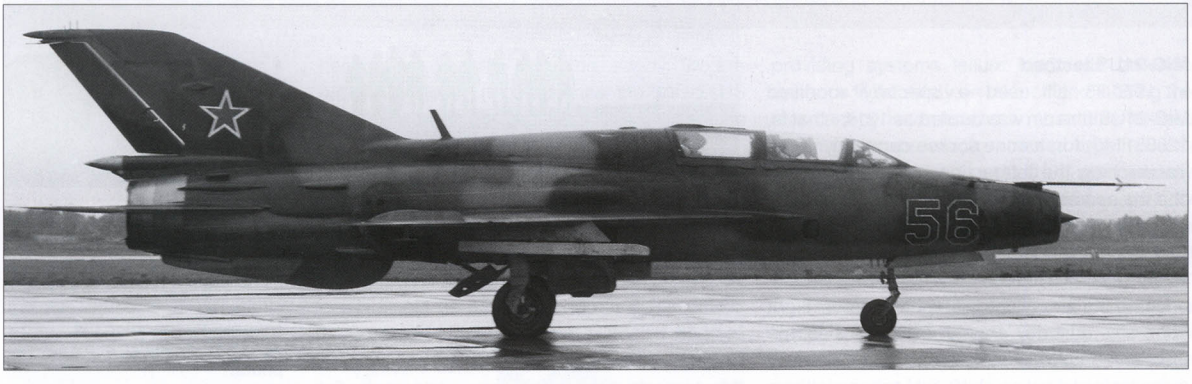


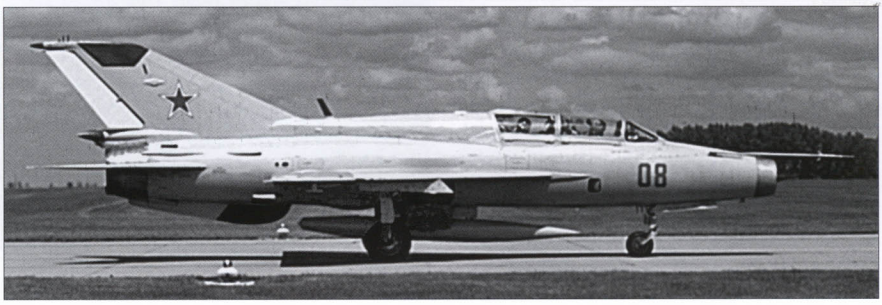
▲▲ **MiG-21UM '10 Blue' operated by the Russian Air Force's 929th State Flight Test Centre (GLITs) in three-tone camouflage with the Centre's 'soaring eagle' badge on the nose. See page 206 for more pictures of this aircraft.**

▲ **Another Soviet Air Force MiG-21UM, '56 Red'. The ultimate trainer version is readily identifiable by the blade aerial on the fuselage spine.**

aircraft, which was only briefly loaned from the CzAF and reregistered temporarily, had other uses. The trainer was subsequently returned to the Air Force and eventually sold to France, gaining the military test registration F-ZAGR.

MiG-21UM conversion/proficiency trainer (Ye-6UM, *izdeliye* 69; *Mongol-B*)

In 1968 the Mikoyan OKB submitted the prototype of the improved Ye-6UM trainer (*modernizeerovannyy* – updated) for State acceptance trials; in 1971 the aircraft entered production in Tbilisi as the MiG-21UM or *izdeliye* 69. This ultimate trainer version differed from the MiG-21US first and foremost in having the more powerful R13-300 engine rated at 4,100 kgp (9,040 lbst) at full military power and 6,600 kgp (14,550 lbst) in full afterburner. Other changes included the installation of a new AP-155 three-channel autopilot, which had a feature enabling automatic recovery from unsafe altitude, and a new ASP-PFD-21 gunsight. For ease of maintenance the avionics were now mounted on a pallet that could be lowered clear of the aircraft. The canopy jettison system was modified, allowing both canopies to be jettisoned from the front cockpit; however, the instructor could jettison his canopy independently with the forward canopy already gone. The MiG-21UM featured new control sticks with grips mounted on universal joints and provided with micro switches that allowed the pilot to override the



EMZ

▶ **This MiG-21UM coded '08' served as a camera platform. The aircraft is painted light grey overall, except for the extreme nose.**

autopilot when sufficiently high forces were applied.

Outwardly the MiG-21UM was readily identifiable by the wide blade aerial of the R-832 radio mounted on the fuselage spine a short way ahead of the fin. Additionally, from 1972 onwards a prominent fairing carrying an AoA sensor vane was mounted on the port side of the extreme nose (some MiG-21USs had this fairing, too). AoA indicators were provided in both cockpits.

The MiG-21UM was produced both for the 'home market' and for export; the export version was virtually identical to the domestic one. Some early-production examples, however, were fitted

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Siete Meeter

▲
MiG-21US used by LII in an unidentified test programme. Note the camera fairings on the port side of the fuselage and at the top of the fin.

◄
The same aircraft, now coded '68 White outline', sits in storage on the south side of the LII airfield in 2002. The camera fairing on the fin has been removed.

MiG-21US '68 White outline' as a gate guard in front of the Test Pilots School at Zhukovskiy.
▼

Il'ya Morozov

Sergey Scrynnikov

▲
A MiG-21UM operated by RSK MiG in three-tone camouflage takes off in full afterburner. MiG-21UM '204 White' is operated by BVVAUL.
▼

Yefim Gordon

Yefim Gordon

Sergey Scrynnikov

with the old R11F2S-300 engine. A total of 1,133 were built in 1970-85. The NATO reporting name was the same as for the MiG-21US (*Mongol-B*).

Again, MiG-21UMs up to and including Batch 75 had the same c/n system. In mid-1973, however, a new nine-digit system featuring the 'famous last five' was introduced. For example, 516945036 – that is, plant No. 31, *izdeliye* 69, the remaining five digits signify nothing. The first two of these five are always an odd number, while the last three originally increased in increments of five so that the c/n always ended in a 1 or a 6. When the 'famous last five' reached 99096, the last three digits started accruing continuously.

MiG-21UM chase aircraft

A single MiG-21UM coded '08' was converted into a chase plane/camera platform similar to the MiG-21U-OP (see above). Again, the conversion was performed by the Myasishchev OKB.

MiG-21UM Lancer B conversion/proficiency trainer

Ten (some sources say 14) of the Romanian Air Force's MiG-21UM trainers were upgraded to Lancer B standard by Aerostar and IAI; the equipment was broadly similar to that of the single-seat Lancer A/C, except for the lack of radar. The aircraft was able to carry Rafael Python 3 AAMs; the take-off weight with four such missiles was 8,200 kg (18,080 lb), while range with two AAMs and three 490-litre drop tanks was 740 km (460 miles).

The Lancer B prototype ('327 Black', c/n 516999327) first flew on 6th May 1996.

MiG-21UMD conversion/proficiency trainer

This unofficial designation (D = *doradjen* – updated) applied to four Croatian Air Force MiG-21UMs which were upgraded by Aerostar

Sergey Scrynnikov

in Romania in 2003. The MiG-21UMD had a revised avionics fit giving NATO interoperability.

MiG-21UR tactical reconnaissance aircraft (Ye-6UR) (project)

In 1961 the Mikoyan OKB developed a tactical reconnaissance aircraft based on the Ye-6U trainer; the machine was designated MiG-21UR or Ye-6UR, the R standing for *razvedchik*. The former rear cockpit was transformed into a camera bay. The project did not materialise.

MiG-21UM-97 trainer upgrade (project)

In 1997 the Mikoyan OKB developed a mid-life update programme for the MiG-21UM trainer in order to facilitate conversion and proficiency training of pilots flying the upgraded MiG-21-93 (MiG-21 Bison) and MiG-21-98-1 fighters. The upgraded aircraft, which was designated MiG-21UM-97, was to share the new avionics of the upgraded single-seaters. So far the project remains on the drawing board.

***

The two-seat versions of the MiG-21 have seen service with the VVS and PVO, as well as the air arms of all Warsaw Pact states and other 'friendly nations' operating the MiG-21. The early MiG-21U (*izdeliye* 66-400 and 66-600) turned out to be easier to master than the later MiG-21US and MiG-21UM, which required more extensive prior training on subsonic types. Nevertheless, the Mongol has soldiered on for many years, and many nations have retired it only recently, despite having operated more modern types alongside it.

▲
This MiG-21UM with a MiG logo and a Russian flag is operated by the NAZ Sokol aircraft factory.

◄
A Romanian Air Force MiG-21UM Lancer B.

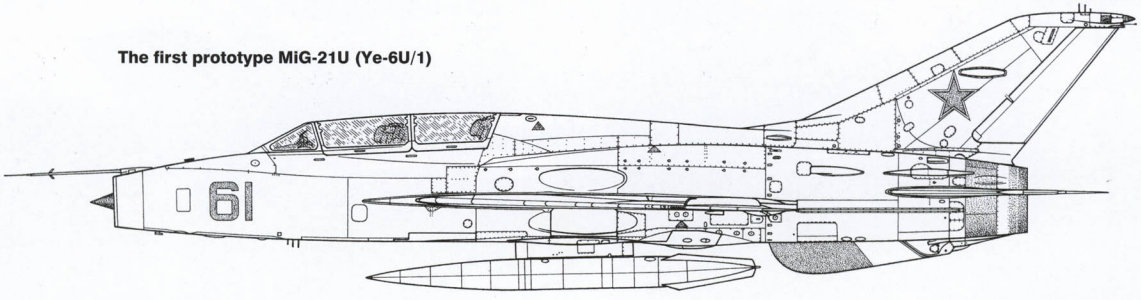
Details of the Lancer B – an ESM antenna on the nose and the multi function display in the rear cockpit.
▼

Carlo Kuit

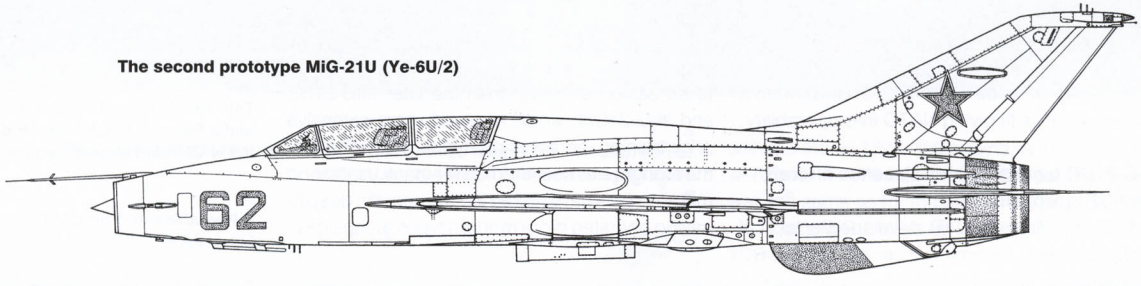
Cris Lofting

Alexandru Trandafir

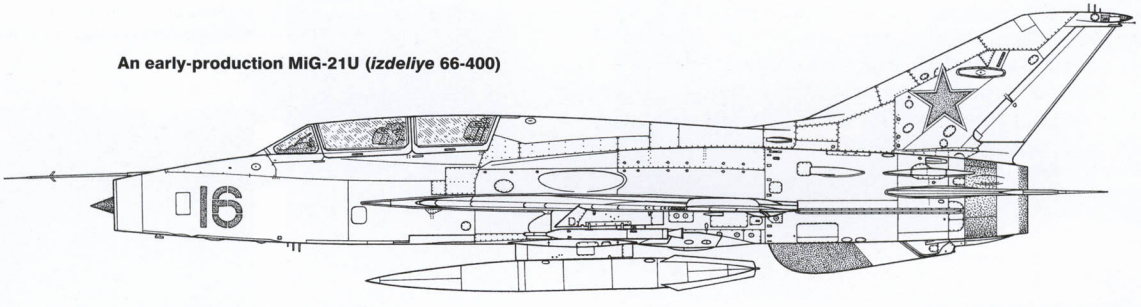
The first prototype MiG-21U (Ye-6U/1)



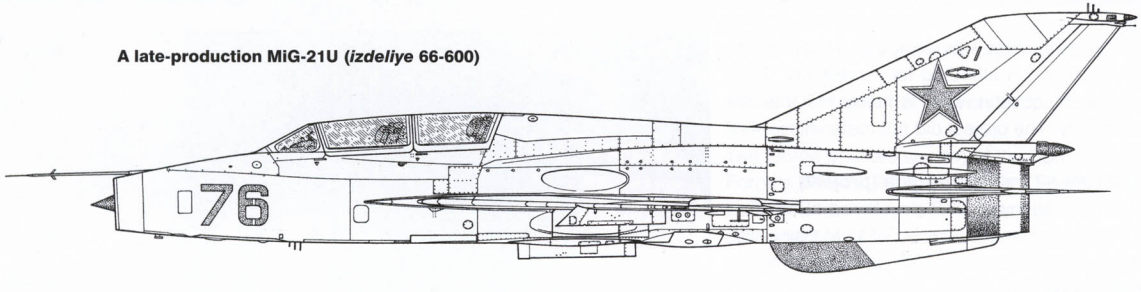
The second prototype MiG-21U (Ye-6U/2)



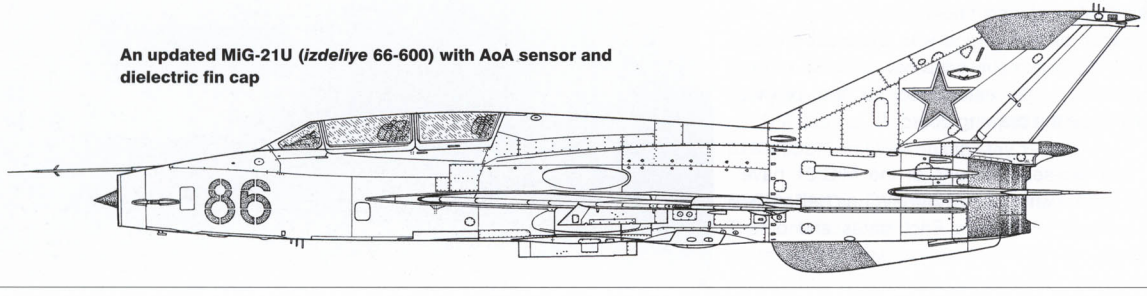
An early-production MiG-21U (*izdeliye* 66-400)



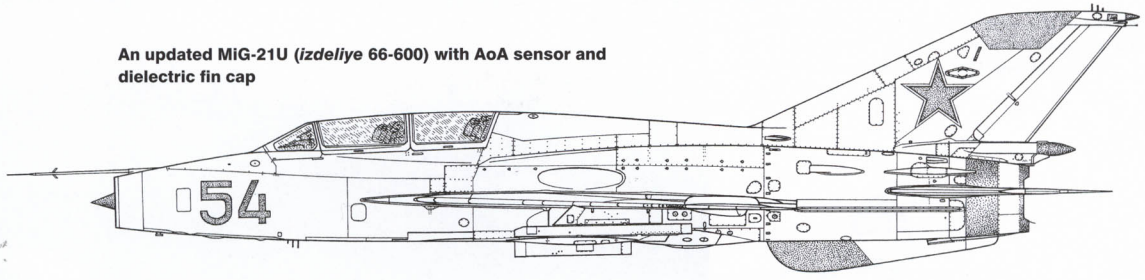
A late-production MiG-21U (*izdeliye* 66-600)



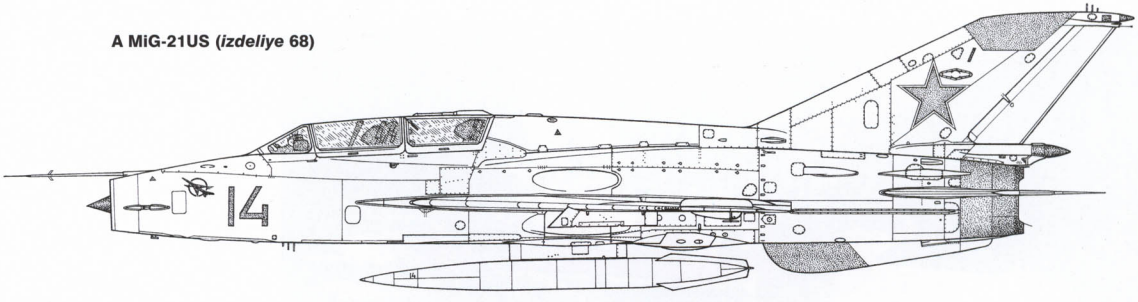
An updated MiG-21U (*izdeliye* 66-600) with AoA sensor and dielectric fin cap



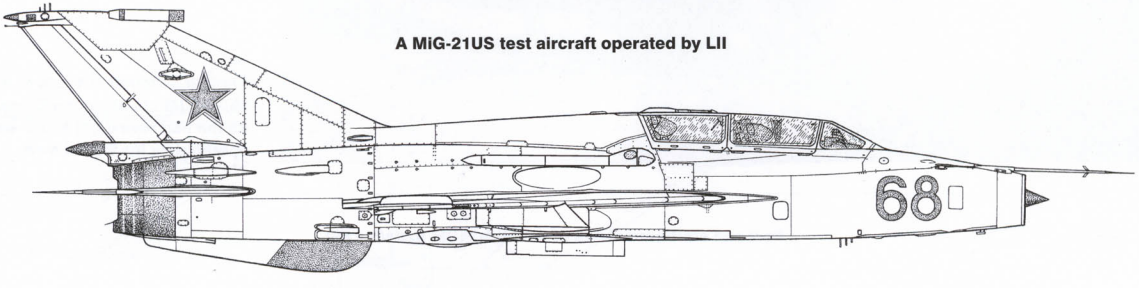
An updated MiG-21U (*izdeliye* 66-600) with AoA sensor and dielectric fin cap



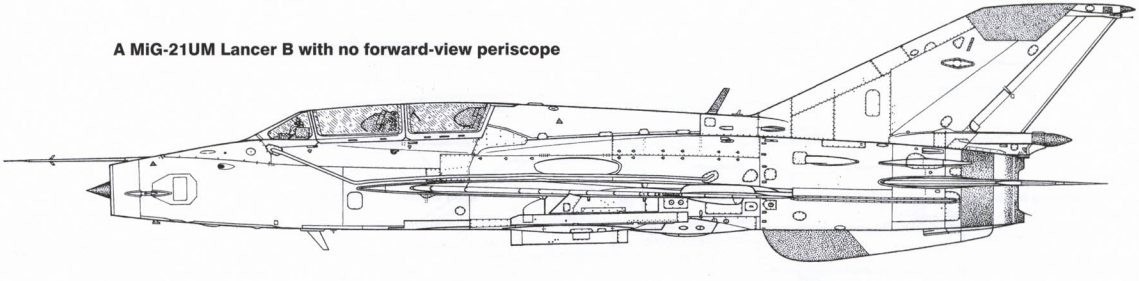
A MiG-21US (*izdeliye* 68)



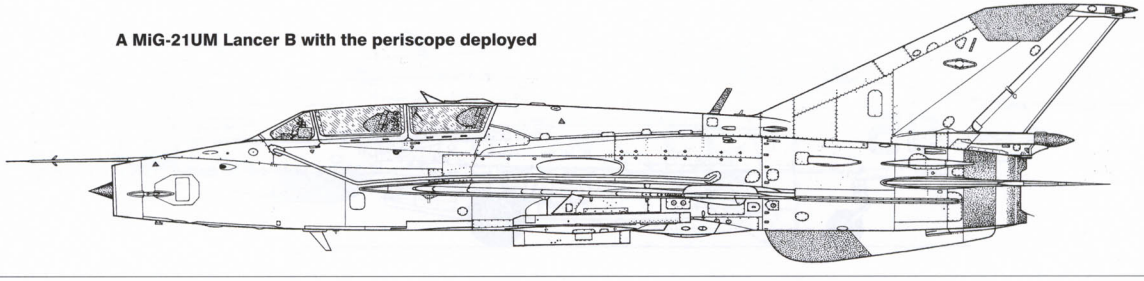
A MiG-21US test aircraft operated by LII



A MiG-21UM Lancer B with no forward-view periscope



A MiG-21UM Lancer B with the periscope deployed



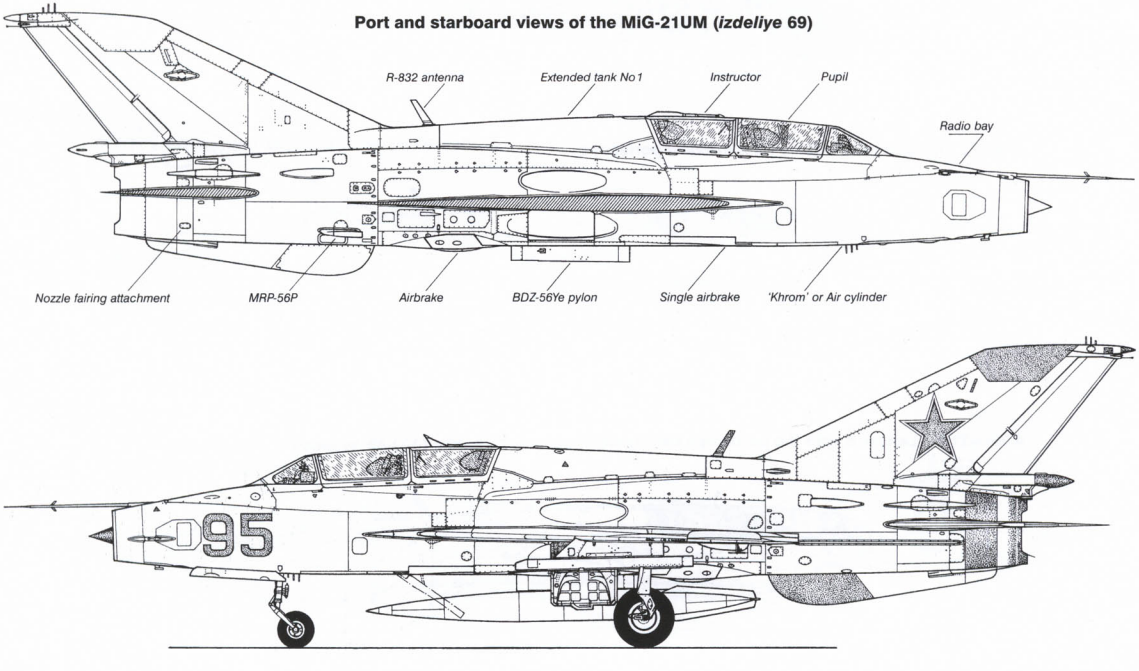
▶ **The end of the road: a MiG-21UM or MiG-21US on the dump at Severomorsk-3 AB in company with single-seat MiG-21s. Note the variance in camouflage colours.**

Yefim Gordon

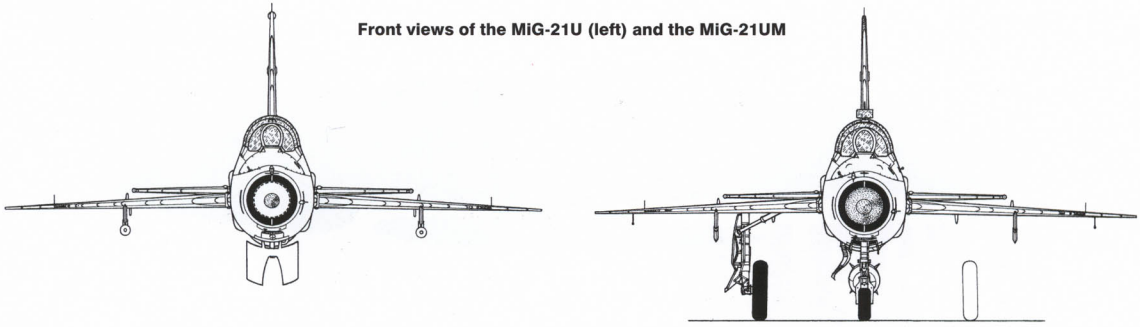
Victor Drushlyakov

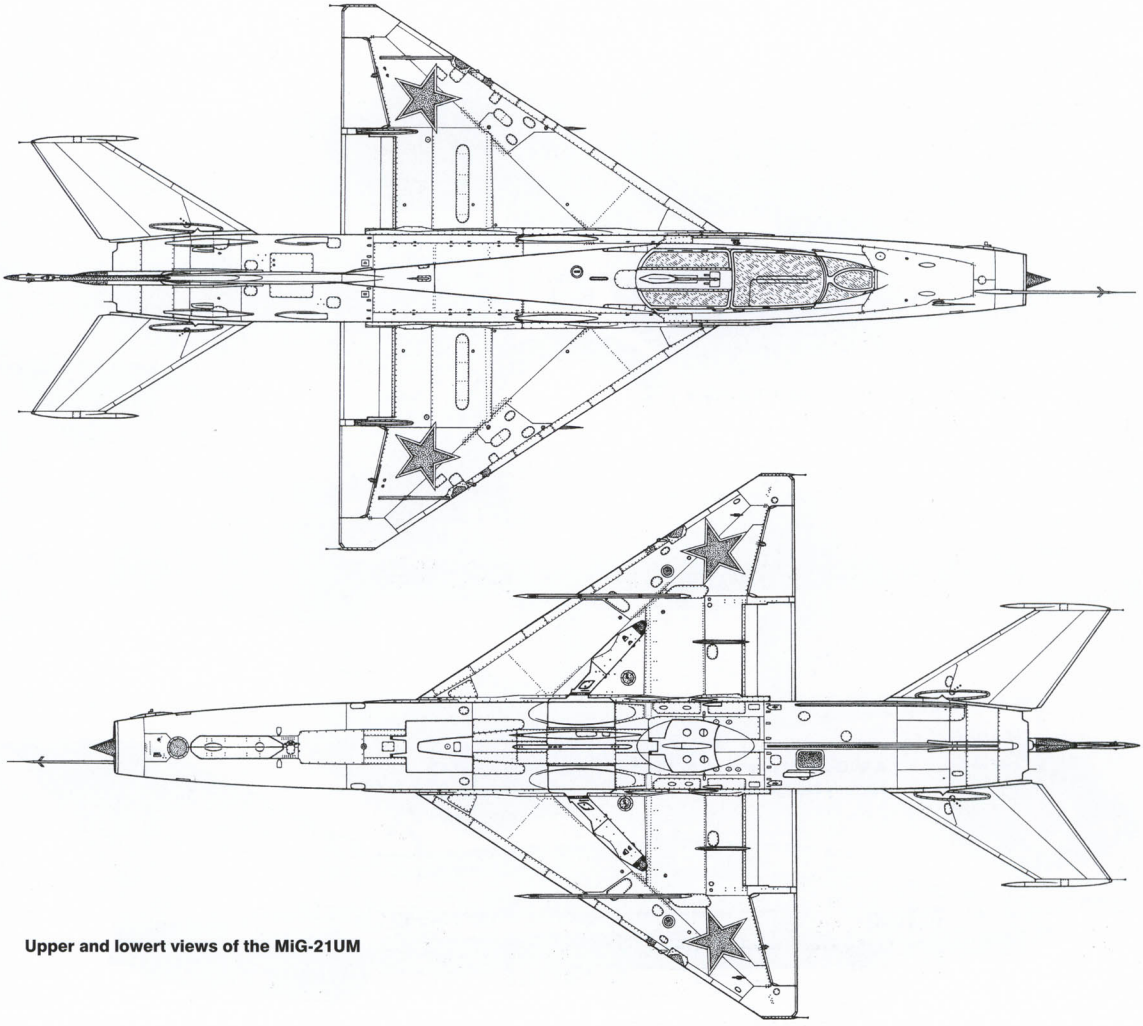
◀ **Another stripped-out hulk of a MiG-21UM at Saki in the Crimea. As the flag reveals, '10 Red' was operated by the Soviet Navy.**

Port and starboard views of the MiG-21UM (*izdeliye* 69)



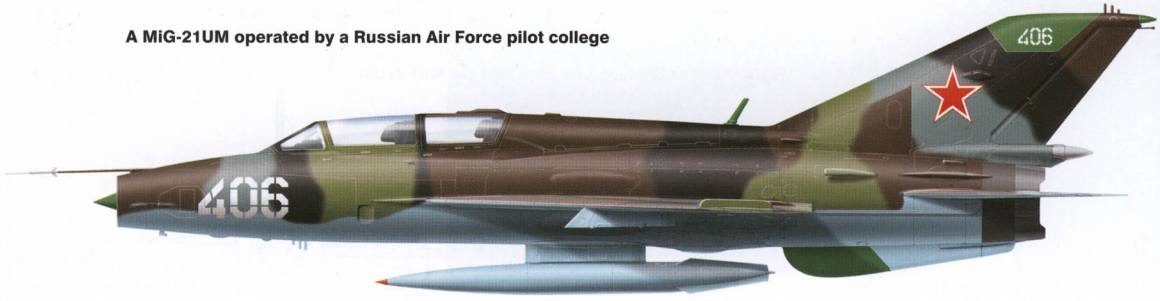
Front views of the MiG-21U (left) and the MiG-21UM





Upper and lowert views of the MiG-21UM

A MiG-21UM operated by a Russian Air Force pilot college



Russian Air Force (929th GLITs) MiG-21UM; the badge is applied to both sides of the nose

A MiG-21UM operated by the Soviet Navy

A MiG-21UM operated by the NAZ Sokol aircraft factory, Nizhniy Novgorod

PART SIX

EXPERIMENTS AND PROJECTS

Ye-8 fighter prototypes (MiG-23 (second use of designation), later MiG-21M)

Once the Ye-7 (MiG-21PF) interceptor had entered production, the design staff of OKB-155 began refining the MiG-21 along several different lines of development. One of them resulted in an interceptor bearing the manufacturer's designation Ye-8.

The aforementioned VPK ruling of 30th May 1960 ordering the Ye-7 into production contained a clause requiring the Mikoyan OKB to develop and build the MiG-23 interceptor (the first aircraft to bear this designation); this was to be based on the MiG-21PF and be equipped with a new S-23 weapons system. In due course the MiG-23 was to supersede the MiG-21PF on the production line. Like its predecessor, the Ye-8 (MiG-23) was designed for attacking aerial targets in head-on mode in all weather conditions in daytime and at night. Its weapons system was to comprise:

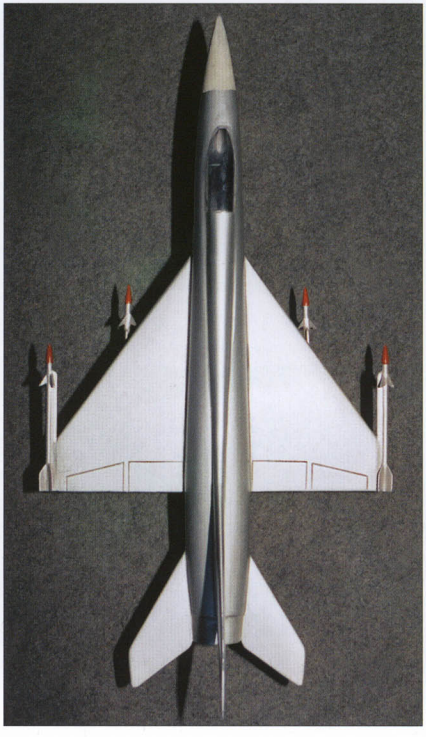
- a Sapfeer-1 (S-1) fire control radar, which was to be replaced by a Sapfeer-2 (S-2) quasi-continuous pulse radar later on;
- an ASP-PF computing gunsight;
- a Spektr (Spectrum) infrared search & track (IRST) unit;
- two K-23 long-range AAMs.

Development work began in 1960. A general arrangement drawing of the Ye-8 to 1/20th scale was endorsed on 22nd December; a cutaway drawing followed on 25th December. The Ye-8 was a very different aircraft; although it was supposedly based on the Ye-7, which had completed its test programme by then, not much was left of the original design except the wings and the main landing gear units. The fighter's general arrangement was altered considerably; this was due first and foremost to the need to accommodate the new Sapfeer-1 radar whose antenna had a much larger diameter than that of the TsD-30T radar fitted to the Ye-7. Furthermore, the Ye-8's higher take-off weight necessitated installation of a new engine offering an increase in take-off thrust of at least 800-1,000 kgp (1,760-2,205 lbst) over the production R11F-300.

The Ye-8's powerplant, which was based on the R11F-300 turbojet, was not developed by the head office (OKB-300) under General Designer Sergey K. Tumanskiy. The design office of plant No. 500 in Tushino, Moscow, manufacturing the R11 engine (OKB-500 headed by Nikolay G. Metskhvarishvili) took on the job. The designers were faced with the need to obtain a substantial thrust increase while retaining the basic dimensions of the engine. A new approach to upgrading the engine was required, and the designers opted for the 'minor increment' method, increasing the basic parameters of the engine by a small amount. The diameter of the compressor flow passage and the compressor speed were increased to provide a higher mass flow, in addition, the compressor blades were reprofiled to increase the compressor's efficiency and hence the engine pressure ratio. New heat-resistant alloys were used for the turbine, making it possible to increase the turbine temperature. The principal subassemblies of the engine, including the compressor discs, were reinforced to withstand the higher structural loads.

Designated R21F-300, the new engine shared the systems of its progenitor, including the oxygen feed system facilitating relight after a flameout at high altitude and the intake assembly de-icing system. Air bleed valves for the boundary layer control (BLC) system were provided in the high-pressure compressor section.

The front end of the afterburner was connected to the engine casing by an unconventional telescopic joint, while the rear end was supported by rollers moving along longitudinal tracks attached to the fuselage frames. This design was intended to reduce considerably the



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► **A desktop model depicting a projected configuration of the MiG-23 (Ye-8) fighter with two of the four AAMs carried on wingtip launch rails.**

stresses applied to the rear fuselage structure due to the afterburner's heating/cooling cycles during operation. The afterburner featured a continuously variable ejector-type nozzle with two petals featuring inner and outer segments. The fuel combustion in the afterburner was so carefully optimised that the maximum afterburner mode provided a thrust increase of 55% over the dry rating.

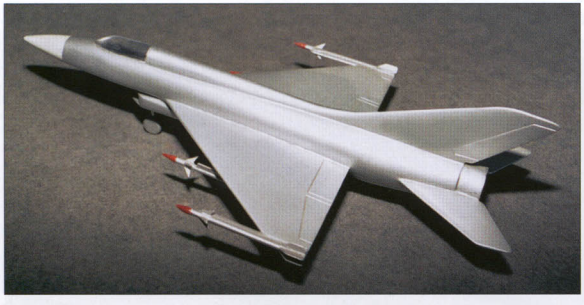
The manufacturer's bench tests of the R21F-300 proceeded successfully: the principal target performance figures were obtained at an early stage with the third prototype engine. Mass flow was increased from 64.5 kg/sec (142 lb/sec) on the R11F2S-300 to 74 kg/sec (163 lb/sec); the thrust in full afterburner was increased from 6,175 kgp (13,610 lbst) to 7,200 kgp (15,870 lbst). The R21F-300 had a casing diameter of 845 mm (2 ft 9 17/64 in), an afterburner diameter of 987 mm (3 ft 2 55/64 in) and a dry weight of 1,250 kg (2,755 lb). In comparison, the respective figures for the R11F2S-300 were 772 mm (2 ft 6 25/64 in), 902 mm (2 ft 11 33/64 in) and 1,165 kg (2,570 lb). In other words, the designers of the R21F-300 had almost succeeded in keeping their engine within the predecessor's dimensions and weight.

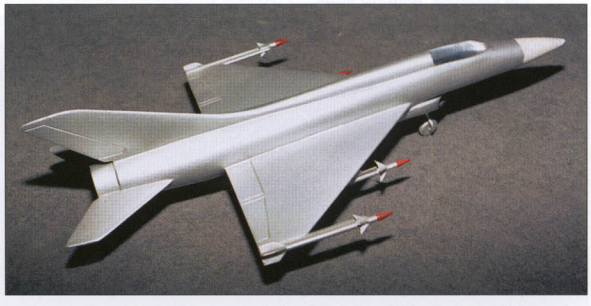
With an extra tonne of available thrust and improved aerodynamics, the Ye-8 was expected to have a much better performance and higher manoeuvrability than the Ye-7. The new fighter's design take-off weight was 6,800 kg (14,990 lb); thus, the R21F-300 engine gave it a thrust/weight ratio of 1.05.

As noted earlier, the new weapons system entailed a massive redesign of the airframe because the Sapfeer-1 radar was too large to fit inside a nose-mounted air intake. The air intake received special attention; its configuration and placement were carefully chosen in order to ensure a uniform airflow velocity field and minimise pressure losses within a wide range of pitch and yaw angles. A series of experiments made it possible to determine the new fighter's overall aerodynamic layout, the air intake design, the arrangement of the tail surfaces and the design of the high-lift devices. The fuselage had to be designed anew because the large antenna and radome of the radar chosen initially dictated a chin-mounted air intake. This, in turn, necessitated a redesign of the landing gear and hence an increase of the aircraft's ground angle – the Ye-8 had a pronounced nose-up attitude on the ground. The air intake, which was positioned below the cockpit, had a hexagonal cross-section at the inlet (with a slightly convex top and bottom) and a V shape in plan view; the upper lip was set apart from the forward fuselage underside, acting as a boundary layer splitter plate.

Right from the lip the air intake was divided into two inlet ducts by a vertical splitter accommodating the nosewheel well; the ducts merged at fuselage frames 15-16 ahead of the engine compressor face. The splitter incorporated two multi-segment three-shock airflow control ramps; twin auxiliary blow-in doors were located on the sides of the intake trunk.

More views of the Ye-8 model, showing the ventral V-shaped air intake positioned well aft and the large radome.
▼





All photos Yefim Gordon

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'81 Red', the first prototype of the Ye-8 fighter (Ye-8/1). These views illustrate the canards with anti-flutter booms, the revised vertical tail and the ventral fin folded to provide ground clearance.

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This view of the Ye-8/1 shows the air intake with lateral blow-in doors, the large nosewheel and the metal nosecone replacing the intended dielectric radome, which was to terminate ahead of the canards' leading edge.

The air intake ramps were actuated electrohydraulically, with a maximum travel of 140 mm (5 3/4 in); their position was adjusted smoothly to suit the engine pressure ratio, which varied from 4.0 to 10.4, depending on the operating conditions. Automatic adjustment of the ramps was enabled after landing gear retraction; with the gear down, and with the engine running at maximum EPR, the ramps were retracted, maximising the cross-section area of the inlet ducts. A special mechanism in the air intake splitter made sure that the port and starboard ramps moved symmetrically. The gaps between the movable ramp segments and the inlet duct walls were sealed by inflatable rubber hoses. A UPES-3 gauge in the cockpit indicated the

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position of the ramps' centre segments; when the needle was down to zero the ramps were fully retracted (maximum cross-section area) and when it was at 10 the ramps were fully deployed (minimum cross-section area).

Apart from the normal automatic mode, the intake ramps had a manual control mode used as a back-up in flight and for checking the ramps' operation on the ground. This mode allowed the position of the ramps to be varied throughout their travel range. The auxiliary blow-in doors were spring-loaded and opened on the ground and on take-off; they closed in cruise flight when the pressure in the inlet ducts built up.

To minimise the risk of foreign object ingestion during taxiing, take-off and landing the nose landing gear unit was moved aft 1.6 m (5 ft 3 in) and placed under the air intake trunk; this reduced the wheelbase to 3.35 m (10 ft 11$^{57}/_{64}$ in). The levered-suspension nose gear unit was designed anew, retracting aft into the air intake splitter; it featured a breaker strut and was fitted with a larger 660 x 200 mm (25.98 x 7.87 in) KT-108 wheel. As noted earlier, the main gear units were stock MiG-21PF items and permitted operations from unpaved strips.

The vertical tail was recontoured, having a more rounded tip and a larger dielectric fin cap. It was augmented by a greatly enlarged ventral fin to improve directional stability. To provide adequate ground clearance the lower portion of the ventral fin folded hydraulically through 90° to starboard; it was horizontal on the ground, unfolding concurrently with landing gear retraction and folding again during gear extension. This ingenious design worked well and was subsequently used on the 'real' MiG-23 – the fighter that entered production and service under this designation (NATO reporting name *Flogger*) – and its MiG-27 strike derivative.

The Ye-8 had a slightly downward-angled ogival nosecone ahead of the cockpit; nearly half of it was to be formed by a dielectric radome which was tipped with a pitot boom carrying pitch and yaw vanes. Located immediately aft of the radome and ahead of the cockpit was the Ye-8's second most characteristic feature – canard foreplanes (known as 'destabilisers' in Russian terminology) with a span of 2.6 m (8 ft 6$^{23}/_{64}$ in). The canards were of cropped-delta planform, with anti-flutter booms at mid-span. The canards lacked actuators, not being intended for active pitch control. At subsonic and low supersonic speeds they rotated freely on their spindles, aligning themselves with the airflow; at Mach 1.9 the canards were locked neutral, changing the aircraft's aerodynamic focus and reducing longitudinal stability, which would otherwise be excessive in supersonic flight. The locking proceeded smoothly, causing no piloting complications. The canards more than doubled the fighter's lift/drag ratio at Mach 1.5 and higher speeds (at Mach 2.0 the increase amounted to 100%). At Mach 2.0 the canards increased the fighter's G limit at 15,000 m (49,210 ft) from 2.5 to 5.1, giving a substantial improvement in agility. The Ye-8 was not the first MiG-21 derivative to feature canards; before that, similar unpowered canards had been tested on the Ye-6T/3 CCV (see Chapter 2).

Placing the radar in the nose proper instead of an air intake centrebody not only made it possible to use an antenna of greater diameter but also increased the antenna's scanning angles and afforded more room for the radar set. It was also an asset from a maintenance standpoint, facilitating access to the radar set.

The flight controls and the hydraulic system were borrowed from the production MiG-21PF, except for the changes associated with the canards and the folding ventral fin. Another change to the hydraulics was due to the fact that the Ye-8 had only one airbrake instead of three; the pentagonal perforated airbrake was located ventrally in line with the wing trailing edge. The

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▲ **The second prototype, '82 Red' (the Ye-8/2).**

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Unlike the first prototype, the Ye-8/2 had missile pylons but still lacked the radar. Here it is seen with dummy K-13 AAMs. ▼

▲ ►
Front and rear views of the Ye-8/2, showing details of the air intake and the engine nozzle. The wing pylons were located close to the main gear units.

►
These views illustrate well the Ye-8's pronounced nose-up attitude on the ground, the nozzle petals of the R21F-300 engine and the limited clearance below the folded ventral fin. The front end of the ventral fin's fixed portion is dielectric. Unlike the Ye-8/1, the nosewheel well doors are closed when the landing gear is down.

All photos RSK MiG

wings and stabilators were likewise borrowed from the MiG-21PF, with appropriate modifications for mating them with the new fuselage; the stabilators were located 135 mm (5⅜ in) lower with respect to the fuselage waterline in comparison with the MiG-21PF.

The fuel system comprised five fuselage tanks and four wing tanks (the latter were located fore and aft of the middle spar). For the first time in the Mikoyan OKB's practice, four of the five fuselage tanks were integral, not bladder tanks. Provisions were made for carrying a 600-litre (132 Imp gal) drop tank on a centreline pylon.

The Ye-8's cockpit canopy and crew rescue system differed from those of the MiG-21F-13 and MiG-21PF; they were similar (but not identical) to those of the later MiG-21PFM. In common with the latter model, the canopy had a fixed windshield (featuring an optically flat windscreen and two curved sidelights) and a hinged portion opening to starboard. The cockpit was provisionally equipped with an SK-3 ejection seat, which was to be replaced later with the KM-1 seat then under development at the Mikoyan OKB (the latter seat found use on all MiG-21 versions from the *izdeliye* 94 onwards). Not least due to the design of the ventral fin the brake parachute was housed in a fairing at the base of the rudder, as on the Ye-6V and Ye-7SPS prototypes and subsequent production models. This made it possible to deploy the parachute immediately before touchdown without causing the fighter to pitch down dangerously.

General Designer Artyom I. Mikoyan endorsed the Ye-8's final project configuration on 1st June 1961. By mid-September the designers had integrated the radar set and antenna of the Sapfeer radar with the fighter's forward fuselage structure. However, by the end of the year it became obvious that the subcontractors responsible for the radar and the K-23 missile would be unable to deliver either of these items on schedule in time for the tests. Therefore it was decided to equip the Ye-8 with the production TsD-30TP radar, the *Samo**tsvet*** (Gem) IRST unit and two production K-13 AAMs as an interim measure; no cannon armament was envisaged. In this downgraded configuration the Ye-8 received the provisional service designation MiG-21M (*modifi**tsee**rovannyy* – modified), even though, as noted above, it wasn't really a MiG-21 any more. (The MiG-21M designation would later be re-used for an export variant of the actual MiG-21 – see Chapter 4.)

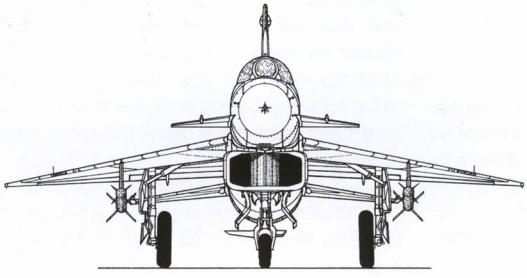
Aptly coded '81 Red', the first prototype (Ye-8/1) was built by MMZ No. 155 in Moscow. On 5th March 1962 the fighter was rolled out at the OKB's flight test facility in Zhukovskiy following reassembly, whereupon the usual ground test cycle began, including installation and calibration of the test equipment, fuel system checks and CG position checks. As was often the case, no radar was fitted, its place being occupied by test equipment; therefore the Ye-8/1 had an all-metal ogival nosecone instead of a dielectric radome.

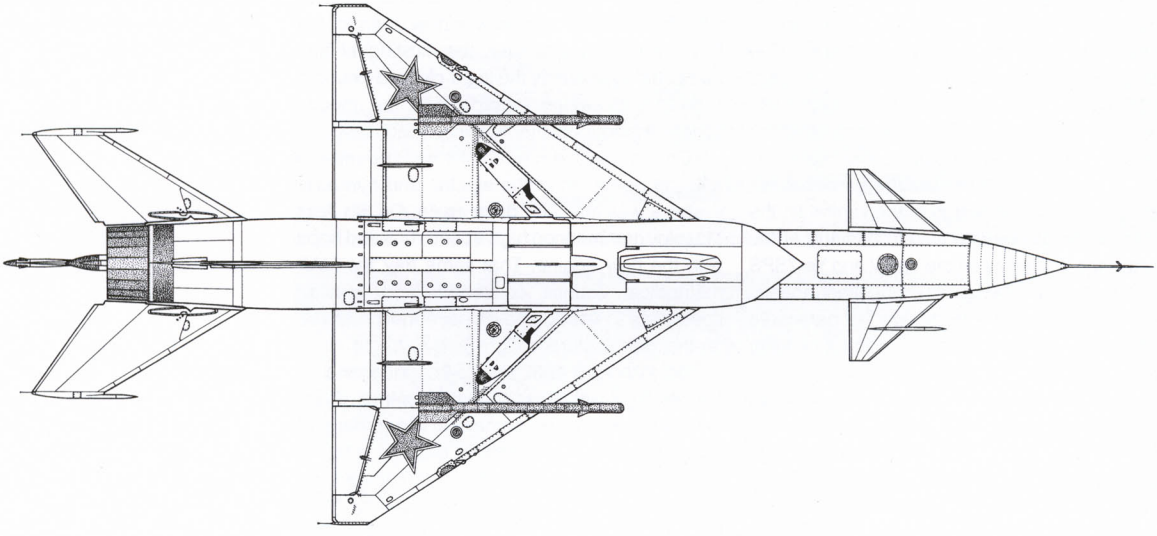
Two prototype engines (c/ns 21-105 and 21-106) were available at the time. It was decided to use the former example for ground tests, while the other engine was earmarked for the flight tests. Once the R21F-300 engine c/n 21-105 had been installed, the first engine runs took place on 22nd March. The following day the Mikoyan OKB's chief test pilot Gheorgiy K. Mosolov made the first taxi attempts and high-speed runs, including a short hop; the pilot was quite pleased with the aircraft. The road was now open for the flight tests; first, however, the existing engine had to be replaced by the flight-cleared example (c/n 21-106) which incorporated the modifications introduced after the final bench tests.

On 3rd April the new engine was ground-run and the operation of the electric and hydraulic systems was checked once again. On 6th April Mosolov commenced high-speed runs and hops with the new engine. That same day the MAP methodical council convened, and aviation specialists in various fields gave the go-ahead for the manufacturer's flight tests to begin.

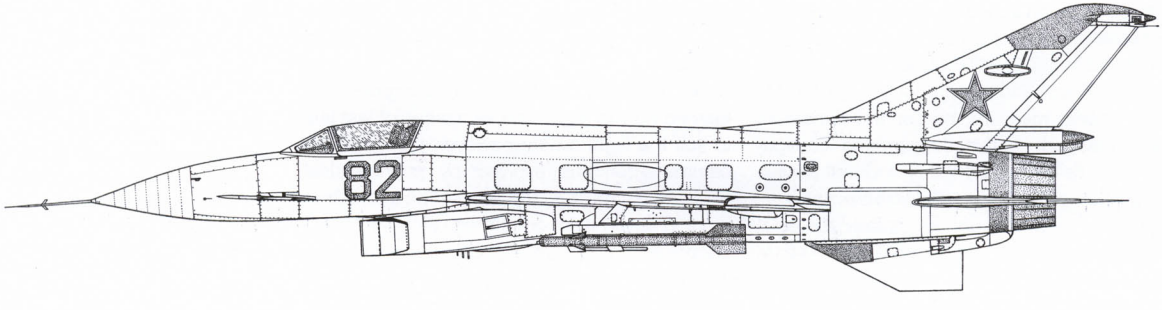
On 17th April 1962 the Ye-8/1 performed its maiden flight with Mosolov at the controls. Since the designers were somewhat apprehensive about how the powerplant in general, and the R21F-300 engine in particular, would operate, in-flight shut-downs and relights were performed in the second and third flights. The next items on the agenda were to check the operation of the aircraft's systems, assess the principal stability and handling parameters of an aircraft equipped with canards, and explore the fighter's acceleration characteristics and speed/altitude envelope.

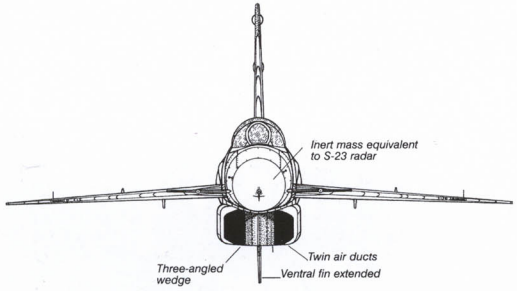
By the early 1960s aircraft designers had learned how to adjust the air intakes of fast jets to suit the flight mode; however, the air intake control algorithms evolved by mathematical analysis usually required verification and refinement in actual flight conditions. With the Ye-8's unconventional air intake design, the task was much more complicated; therefore it was decided not to employ the automatic air intake ramp control system (the pilot was to control the ramps manually). In the Ye-8/1's fifth flight the engine surged and flamed out as it was throttled

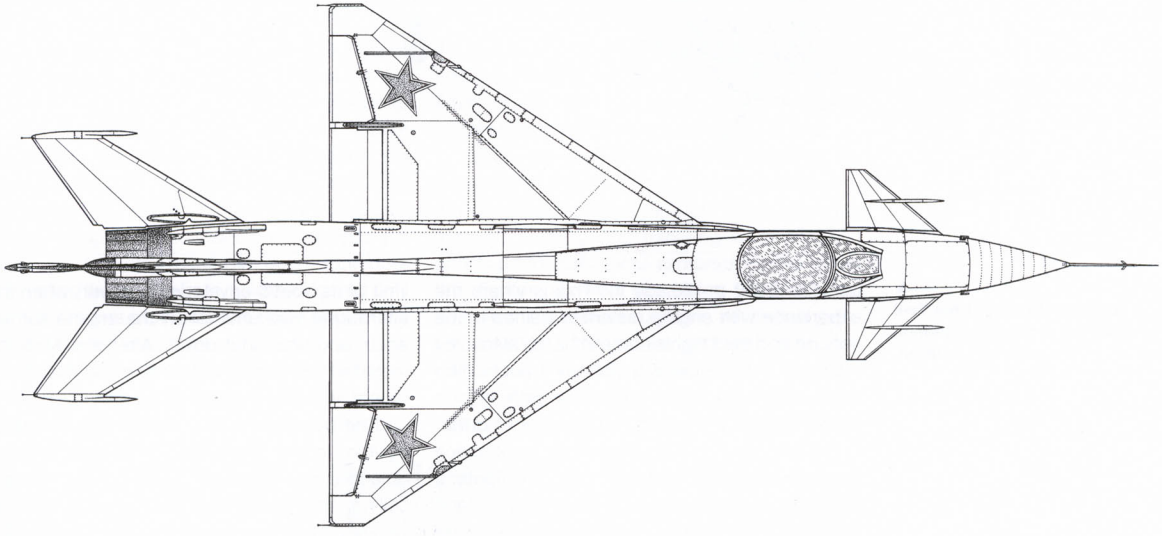




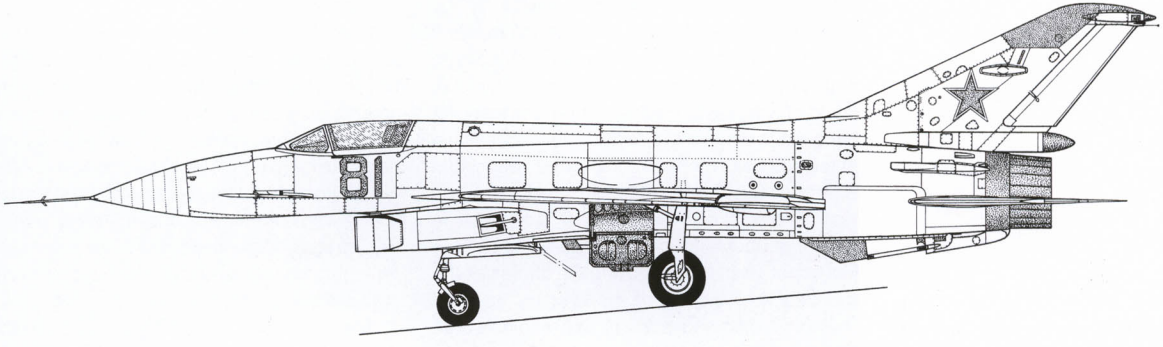
Three views of the Ye-8/2

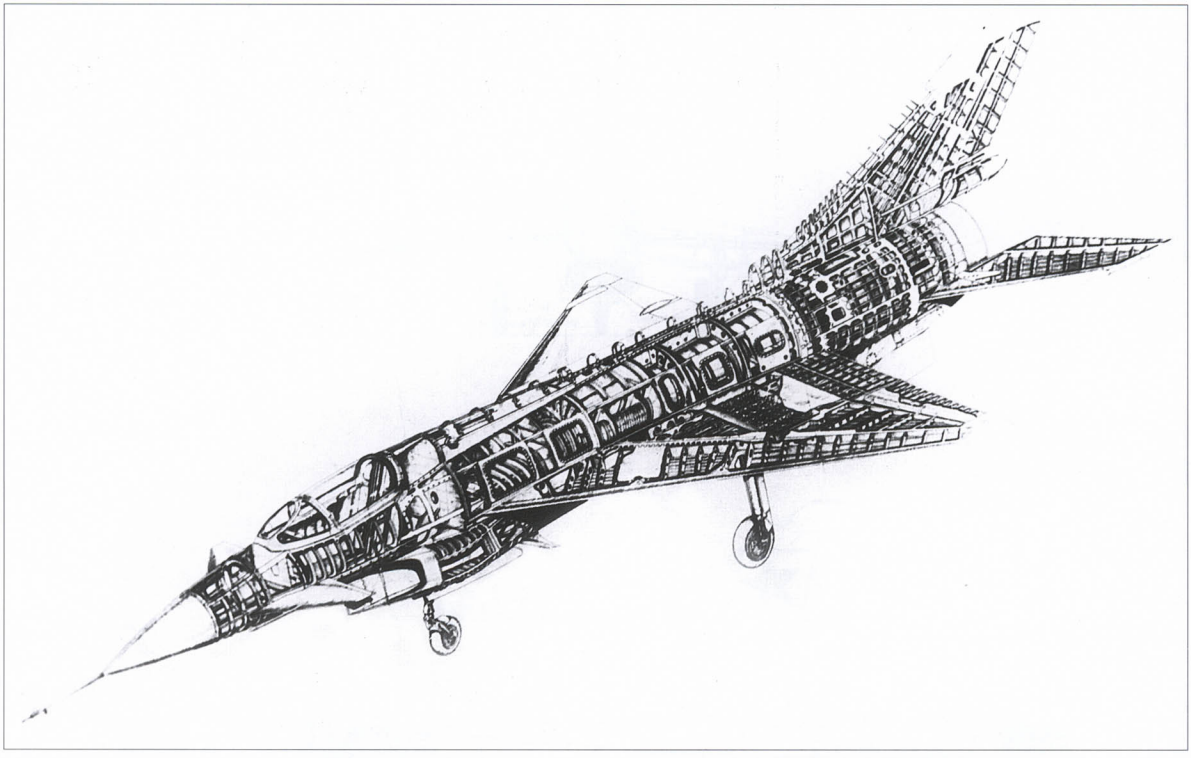






Three views of the Ye-8/1





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▲ **A cutaway drawing of the Ye-8 from the project documents. The engine is omitted.**

back at 8,000 m (26,250 ft). This is where the experience with engine restarting gained in the second and third flights came in handy; Mosolov restarted the engine without any trouble. Nor were there any major problems with engine restarting after flameouts in subsequent flights.

In the next six flights, which took place between 12th May and 7th June, the fighter's acceleration characteristics at different Mach numbers were explored and the service ceiling was determined; the operation of the canards was also assessed. Four engine flameouts occurred in these six flights; they were caused either by surge in the inlet ducts or by compressor stalls. In flight the pilot had to select the intake ramp position manually by flipping a multi-position switch at the right time; this task could only be performed by a top-class test pilot because the aircraft itself was new and as-yet untested. One more problem was associated with the compressor stalls; since engine surge was always accompanied by a sharp rise in turbine temperature, the pilot had to shut off the fuel supply instantly by pulling the throttle all the way back to avoid ruining the turbine.

Notwithstanding the fact that engine surge had been encountered in almost all preceding flights, Gheorgiy Mosolov took the Ye-8/1 to the limit of its speed envelope; however, when the afterburner was shut down the engine surged again and was shut down. After that Mosolov restarted the engine at 12,500 m (41,010 ft) – a record figure for this aircraft type.

The powerplant was not the only source of trouble. In the tenth flight, where the mission objective was to determine the fighter's service ceiling, the Ye-8/1 suddenly started vibrating violently. Realising something had gone wrong, the pilot chose to abort the mission. Upon landing it was discovered that the canards had jammed due to deformation of the locking mechanism.

After the eleventh flight the engine, which obviously had an all-too-small airflow stability margin, was retrofitted with a spacer ring incorporating inlet guide vanes in an attempt to cure the compressor stall problem. Additionally, the intake ramp control programme was revised, taking into account the results of the first few test flights; air pressure sensors were added downstream of the compressor for controlling the ramp position, and the automatic air intake ramp control system was finally enabled.

The ensuing test flights were mainly concerned with verifying the intake ramp control programme in various flight modes, including

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◄ **Mikoyan OKB designers and test personnel beside the Ye-8/2. Project test pilot Gheorgiy K. Mosolov is third from left and General Designer Artyom I. Mikoyan is fourth from left.**

manoeuvres. The *modus operandi* was simple: Mosolov disabled the automatic control system and manually selected a position of the ramp ensuring stable operation of the entire powerplant. Still, despite the modifications, the engine's airflow stability margin remained extremely low; in the 25th flight an especially severe compressor stall occurred. Despite his quick reaction, the pilot did not succeed in preventing the engine from overheating; not only the steel engine casing but the entire engine bay cooling shroud were coloured in temper colours.

Between 23rd June and 22nd July the Ye-8/1 made a further eight flights under the manufacturer's flight test programme, whereupon the ventral fin folding actuator failed and a fuel leak was discovered in the No. 5 fuselage tank. After repairs had been done, six more flights followed between 29th July and 2nd August.

Of course, the testing was not limited to the powerplant. All of the Ye-8's systems (including the canards) were put through their paces, the aircraft's stability and handling were checked and its performance was explored. On the whole the fighter showed promising performance; apart from the weapons system, which had yet to be installed, the main problem was the notoriously unreliable powerplant.

The engine's gas dynamic stability margin had to be improved by all means. Being pressed

RSK MiG

◄ **Mikoyan OKB staff pose with the Ye-8/2. Gheorgiy Mosolov is in the cockpit.**

for time, the engine designers at OKB-500 were compelled to increase the nozzle throat diameter. However, this 'quick fix' had a detrimental effect on the engine's parameters: the R21F-300's afterburning thrust fell from 7,200 to 6,900 kgp (from 15,870 to 15,210 lbst) while the specific fuel consumption was increased.

After two more cases of engine surge and shut-down in the 21st and 25th test flights the original R21F-300 (c/n 21-106) was replaced by a new example (c/n 21-108) incorporating the larger nozzle throat. On 7th September 1962 Gheorgiy K. Mosolov performed a check-up flight in the Ye-8/1 with the new engine.

Four days later, disaster struck. On 11th September an uncontained engine failure occurred in the Ye-8/1's 60th flight when the aircraft was doing Mach 1.7 at 15,000 m (49,210 ft) 60 km (37 miles) south-east of the town of Yegor'yevsk, Moscow Region. It was later established that the 6th compressor stage disk had burst; the fragment ripped through the engine casing and the fuselage side, knocking out both hydraulic systems and rupturing a fuselage fuel tank, and then struck the starboard wing, wiping out the aileron for good measure. A fire broke out; with both hydraulic systems inoperative and the starboard aileron gone, the fighter became uncontrollable and flipped into a spin. The sharp drop in engine thrust caused the compressor and the inlet ducts to stall. As the fighter decelerated, directional oscillations set in; this phenomenon had been encountered earlier when the engine was shut down intentionally. All attempts to regain control were to no avail and Mosolov finally ejected at around 8,000 m (26,250 ft), injuring an arm and a leg in the process. He suffered further injuries on landing; it was another two and a half hours before he was located and rushed to hospital in critical condition. The doctors barely managed to save his life. This is how Mosolov recounted this accident, which put an end to his flying career, in his book *Mig zhizni* (A Moment in Life; the Russian title contains a pun – the word *mig* (fleeting moment) coincides with the MiG acronym):

'It happened at high altitude and high speed. The cockpit filled with smoke at once; the engine froze and the controls jammed. The aircraft became uncontrollable, and suddenly I found myself in the position of a passenger instead of being a test pilot. I could not eject immediately because the speed was too high. As I waited for the speed to bleed off, the aircraft rolled inverted and entered a dive. Ejection was out of the question now…

My head was already injured, one of my arms was broken, and a nagging thought kept tormenting me: It would be a dreadful shame if someone would believe afterwards that I had passed out. No, I hadn't; I was conscious and fighting the aircraft, radioing: "999 (Mosolov's ATC callsign – *Auth.*), *will eject". There was no reply. I repeated, "Triple nine, will eject"; when I got no reply after the third attempt to contact the tower, I pushed the ejection lever and was propelled out into the slipstream. The air stream was hard as concrete; it grabbed my leg (the leg restraint had malfunctioned) and broke it immediately. I fell until my parachute deployed automatically; there was a jolt and… there I was, hanging head downwards under the parachute canopy.*

I had to get rid of the parachute strap, but how on earth could I do it? I had only one good arm, the other arm was hanging limp. Oblivious of the pain, I did my best to pull the strap off my shoulder as the ground came relentlessly closer. Thank God, I finally managed to extricate myself when there were only a few seconds left. I hit the ground with my feet – or rather one foot, as the other leg was broken; I was pierced by pain as my leg bone broke and found myself lying under a spruce tree, in the middle of a forest. I lay there for five hours until the first human being appeared and found me.

I had lost a lot of blood and, realising that I might die there and then, I was in a hurry to tell what had happened to the aircraft and in what flight mode [the accident] had occurred. I asked the man to cut the parachute straps, spread out the parachute canopy on the ground (to assist the search and rescue team in locating the site – *Auth.*) *and make a bonfire. While I still had the strength, I waited for the helicopter to come and get me. Then there was almost a year of waiting on a hospital bed until I could finally feel the floor under my feet…'*

Merited Test Pilot Col. Gheorgiy K. Mosolov, Hero of the Soviet Union and holder of three world speed and attitude records, recovered from his injuries but was no longer fit to fly. He had contributed a lot to the testing and improvement of the MiG-21 fighter.

Thus, in the course of the first prototype Ye-8's 40 flights there had been 11 in-flight shutdowns which were almost invariably preceded by a compressor stall – a highly dangerous phenomenon, as is evident from the above account. As mentioned earlier, Nikolay G. Metskhvarishvili's OKB-500 did its best to improve the R21F-300 engine's unacceptably low gas dynamic stability margin in the course of

the Ye-8's flight tests. The engine's inlet assembly was replaced, the designers tried changing the timing of the air bleed strip and adjusting the automatic fuel feed system; as a last resort, the entire engine was replaced with a modified one. Yet, little good did it do – the R21F-300 remained extremely sensitive to power changes at high flight speeds.

Gheorgiy K. Mosolov, who was unable to sign the test report (referred to below) due to his injuries, gave the following assessment of the Ye-8/1. In the course of 40 flights the aircraft attained a maximum speed of Mach 2.1 and a service ceiling of 20,000 m (65,620 ft). The cockpit afforded a good field of view. The aircraft showed commendable manoeuvrability on the ground and was equipped with effective wheel brakes; when the nosewheel brake was on, the brakes could restrain the aircraft until the engine was revved up to full military power. When the brakes were released, the fighter's ground angle was slightly reduced, improving cockpit visibility, and the fighter was directionally stable during the take-off run. As the flaps were retracted, the fighter pitched down appreciably. Towards the end of the landing run the Ye-8 had a tendency to rock back and forth.

The new fighter's take-off and landing techniques were similar to those of the Ye-7 (MiG-21PF) and the Ye-8 could be easily mastered by all pilots flying supersonic fighters. The Ye-8 pitched down when the landing gear was extended and pitched up when the flaps were deployed; deployment of the airbrake at supersonic speeds also created an insignificant pitch-up force.

Mosolov judged the Ye-8 to have a much greater directional stability margin than the MiG-21PF. In an engine-out gliding descent from 18,000 m (59,055 ft) at Mach 1.7 the fighter was prone to self-induced directional and roll oscillations which were impossible to counter. Apparently these oscillations were caused by the complex airflow patterns in the inlet ducts, because the oscillations vanished when the surge prevention blow-in doors were opened. The fighter was adequately balanced in the roll channel.

Coded '82 Red', the second prototype (Ye-8/2) was completed in May 1962 and fitted with an R21F-300 engine whose c/n was 21-109. The aircraft arrived at the OKB's flight test facility on 22nd June. Like the ill-fated first prototype, the Ye-8/2 lacked radar and had an all-metal nosecone instead of a dielectric radome; however, it did have missile pylons. On 29th June the aircraft made its first flight at the hands of the Mikoyan OKB's new chief test pilot Aleksandr V. Fedotov. By 4th September the machine had made 13 flights; the missions were concerned with powerplant testing, stability, handling and performance testing with dummy K-13 AAMs under the wings and canard vibration tests.

The Ye-8/2 had an empty weight of 4,440 kg (9,790 lb) and a take-off weight of 6,894 kg (15,198 lb). The top speed attained at 15,000 m (49,210 ft) was 2,050 km/h (1,273 mph); the second prototype's service ceiling was 19,650 m (64,470 ft).

The tests revealed the following defects. With the canards unlocked, the Ye-8/2 suffered from

Performance of the R21F-300 engines fitted to the Ye-8 (bench test data)

	c/n 21-108 (first delivery)	c/n 21-109	c/n 21-108 (second delivery)
Thrust in full afterburner (1st mode), kgp (lbst)	6,906 (15,224)	6,894 (15,198)	6,760 (14,903)
Thrust in 2nd afterburner mode, kgp (lbst)	6,775 (14,936)	6,545 (14,429)	6,480 (14,285)
Minimum afterburner thrust, kgp (lbst)	5,660 (12,477)	5,630 (12,411)	5,500 (12,125)
Maximum dry thrust, kgp (lbst)	4,455 (9,821)	4,440 (9,788)	4,350 (9,590)
Nominal thrust, kgp (lbst)	3,695 (8,146)	3,630 (8,002)	3,555 (7,837)
Thrust at 80% of nominal power, kgp (lbst)	2,960 (6,525)	2,930 (6,459)	2,885 (6,360)

Maximum speed of the Ye-8/1 with the R21F-300 engine c/n 21-106

Altitude, m (ft)	Speed, km/h (mph)	Mach number
14,700 (48,230)	2,145 (1,332)	1.99
14,650 (48,060)	2,165 (1,344)	2.0
15,150 (49,700)	2,025 (1,257)	1.88
14,750 (48,390)	2,050 (1,257)	1.9
15,000 (49,210)	2,100 (1,304)	1.925
15,150 (49,700)	2,205 (1,369)	2.024
15,220 (49,930)	2,190 (1,360)	2.034
15,000 (49,210)	2,065 (1,282)	1.915
14,800 (48,560)	2,210 (1,372)	2.015
15,000 (49,210)	2,220 (1,378)	2.035

Maximum speed of the Ye-8/1 and Ye-8/2 with the R21F-300 engines c/ns 21-106 and 21-109

Altitude, m (ft)	Speed, km/h (mph)	Mach number	Aircraft	Engine c/n
2,300 (7,545)	1,100 (683)	0.925	Ye-8/1	21-106
9,800 (32,150)	1,030 (639)	0.955	Ye-8/1	21-106
14,500 (47,570)	2,210 (1,372)	2.03	Ye-8/1	21-106
14,750 (48,390)	2,230 (1,385)	2.05	Ye-8/1	21-106
15,000 (49,210)	2,050 (1,257)	1.9	Ye-8/2	21-109
15,000 (49,210)	2,030 (1,260)	1.885	Ye-8/2	21-109
15,000 (49,210)	2,045 (1,270)	1.89	Ye-8/2 *	21-109

* with two K-13 missiles

canard vibration with a frequency of 10 Hz at Mach 0.9; also, the canards were prone to locking up spontaneously as the landing gear was retracted (the latter defect was cured by installing reverse flow valves). The nosewheel alignment mechanism failed on two occasions; minor leaks in several fuel tanks were detected (incidentally, the Ye-8/2 always flew with the No. 5 fuselage tank empty). It should be pointed out that the BLC system was not activated on either of the prototypes throughout the test programme.

After the loss of the first aircraft the Ye-8/2 was grounded pending investigation of the accident. A while later the programme was cancelled altogether; this decision was taken after analysing all of the Ye-8's shortcomings, and the continued unavailability of a reliable engine was a key factor in this decision. The second prototype sat at the OKB's flight test facility for a long time until eventually disposed of; it served as a ground testbed for certain features of the future MiG-23 *Flogger*.

The following detailed information comes from the 'Manufacturer's flight test report of the Ye-8 experimental tactical fighter/interceptor powered by the R21-300 engine (first and second prototypes)'. (*Sic* – this is how the engine was referred to in the report, even though the proper designation was R21F-300.) The report was signed by the Ye-8's project chief A. G. Broonov, OKB-155 Deputy Chief Designers Gleb Ye. Lozino-Lozinskiy and Gheorgiy A. Sedov and OKB-500 Deputy Chief Designer K. R. Khachatoorov in September 1962 and duly endorsed by General Designer Artyom I. Mikoyan. The concluding part of the report read:

'The Ye-8 aircraft powered by the R21-300 engine has been checked at speeds up to Mach 2.1 and 1,100 km/h [683 mph] IAS – that is, within the speed limits imposed during Stage A of the tests. The aircraft behaved quite acceptably throughout the range of speeds and Mach numbers at which it was tested. Without the K-13 missiles the acceleration time from Mach 1.6 to Mach 2.0 at 15,000 m [49,210 ft] was 82 seconds; the respective figure for the Ye-7 (MiG-21PF) is 86 seconds. The Ye-8/1's static ceiling without missiles was 20,300 m [66,600 ft] versus the target figure of 21,000 m [68,900 ft]; the Ye-8/2's service ceiling was 19,650 m [21,490 ft]. The aircraft climbed to the service ceiling of 19,000 m [62,335 ft] at Mach 1.9.

The unstick speed was 325 km/h [202 mph] with the flaps up and 280-300 km/h [174-186 mph] with the flaps set at 25°. The take-off run was 1,200 m [3,940 ft] and the time from brake release to lift-off was 23.5 seconds. With the engine running in full afterburner the take-off run and time were reduced to 835 m [2,740 ft] and 15 seconds. Using the brake parachute reduced the landing run to 800-900 m [2,620-2,950 ft] and the deceleration time on landing to 20-22 seconds.

At subsonic speeds the aircraft's pitch and roll stability characteristics were similar to those of the Ye-7 (MiG-21PF) fighter. In supersonic flight at Mach 1.37 with the canards locked neutral the Ye-8's static pitch stability margin was 10-12% lower than that of the Ye-7 (MiG-21PF), which improved the fighter's controllability in the pitch channel and manoeuvrability considerably. The provision of the canards made it possible to improve the effective lift/drag ratio from 0.32 to 0.79 at Mach 1.5 and from 0.22 to 0.44 at Mach 2.0. With an all-up weight of 6,800 kg [14,990 lb], the Ye-8's operational G limit at 15,000 m and Mach 2.0 was increased to 5.1 Gs versus 2.5 Gs for the Ye-7 (MiG-21PF). The locking and unlocking of the canards proceeded smoothly and caused no handling complications. The folding of the ventral fin during landing gear extension did not cause any perceptible change in the pitch and roll control characteristics. Aileron authority was comparable to that of the Ye-7 (MiG-21PF).

Vibration of the canards was detected at 9,500-13,500 m [31,170-44,290 ft] and Mach 0.98-1.08; no vibration was experienced when the aircraft was flown with the canards removed. To remedy this, the existing anti-flutter weights on the canards with a total weight of 6 kg [13.2 lb] were replaced with new weights having a total weight of 10 kg [22 lb]; however, the aircraft was not flown in this configuration.

When the engine thrust was set at 7% of the maximum dry thrust, the aircraft suffered from severe lateral oscillations which could not be

A schematic three-view drawing of the Ye-7DPD from the project documents. Note the retractable landing gear; the gear was fixed on the actual aircraft.
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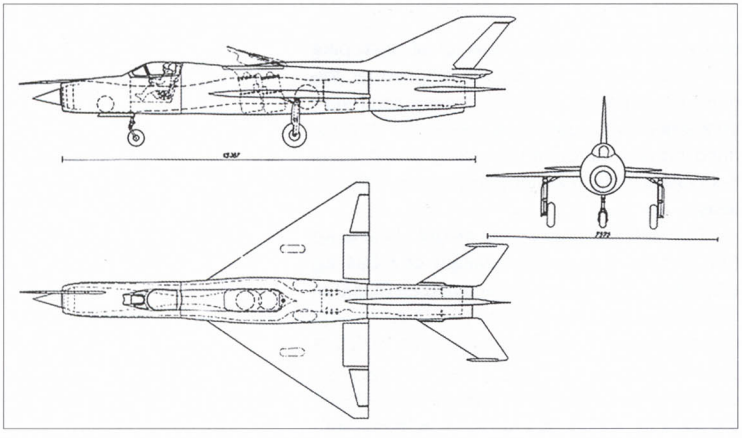

countered by the pilot. In the course of 40 test flights the engine flamed out 11 times at varying altitudes and Mach numbers; this testified to the engine's inadequate gas dynamic stability. The installation of a symmetrical set of inlet guide vanes failed to provide an improvement. Enlarging the nozzle throat diameter allowed the engine to run more stably in afterburning mode but had a detrimental effect on the aircraft's performance. The nozzle's air ejector had an imperfect shape, which meant the maximum possible thrust increase afforded by the ejector was not attained.'

The engines' operating time on the two prototypes was as follows. R21F-300 c/n 21-106 logged 24 hours 31 minutes' total time since new on the Ye-8/1; R21F-300 c/n 21-108 logged 2 hours 14 minutes on the Ye-8/2 (first delivery) and 1 hour 30 minutes on the Ye-8/1 (second delivery), while R21F-300 c/n 21-109 logged 7 hours 48 minutes on the Ye-8/2. The reference to the 'second delivery' means that the engine was redelivered after modifications with a larger nozzle throat diameter.

The concluding part of the report stated:

'Providing the intended S-23 weapons system and the canards are installed, the Ye-8 aircraft powered by the R21-300 engine with no nose air intake will ensure:

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The Ye-7PD (*izdeliye* 23-31) STOL technology demonstrator created as part of the MiG-23 programme was a heavily modified MiG-21PFM. These views show the open air intake scoop of the lift engines, the ventral bulge incorporating the lift engine thrust control vanes, the revised vertical tail, the abbreviated fairing aft of the cockpit and the 'towel rail' data link aerial under the nose. Note the photo calibration markings.

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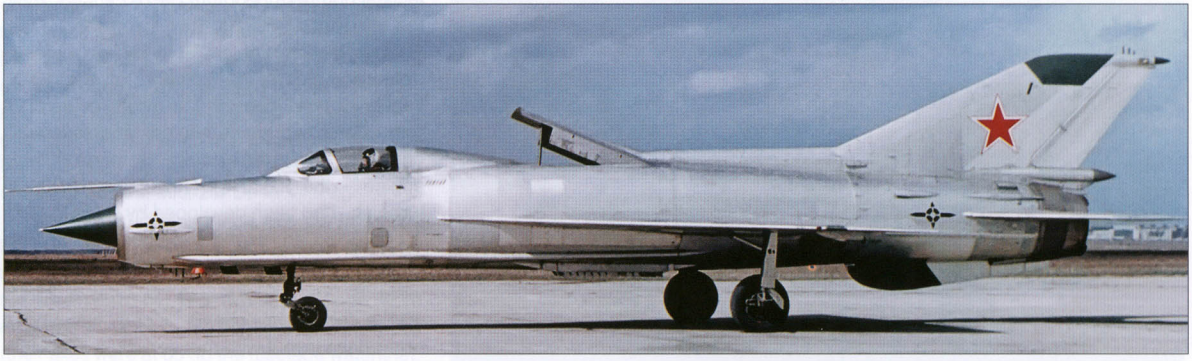


RSK MiG

Boris Vdovenko

Yuriy Skuratov

▲ **The Ye-7PD flies at the Moscow-Domodedovo airshow on 9th July 1967. Note the absence of mainwheel wells (the landing gear was fixed).** ▼

1. Interception of aerial targets in head-on and pursuit modes, which will effectively double the 'kill' zone and increase interception range, and high efficiency against ground targets;

2. Increased aerial target interception capability at low and high altitudes;

Yuriy Skuratov

3. All-weather capability;

4. Higher manoeuvrability and improved handling.

5. The crash of the first prototype was caused by structural failure of the 6th stage compressor disc, which in turn was caused by the narrowing of the gap between the 6th stage disc and the labyrinth seal in the course of operation.'

Ye-8M (MiG-23) interceptor (project)

In 1962 the Mikoyan OKB brought out several versions of the projected Ye-8M interceptor (*modifi**tsee**rovannyy* – modified), which was to feature an upgraded Sapfeer-23P (S-23P) weapons system. This aircraft, which reverted to the provisional service designation MiG-23, was basically similar to the original Ye-8 *sans suffixe*, having the same chin-mounted air intake and the same landing gear design but featuring a slightly larger wing area and a refined version of the Metskhvarishvili R21F-300 turbojet. One of the project versions had a rather different configuration with lateral air intakes; this feature was meant to reduce the risk of foreign object ingestion.

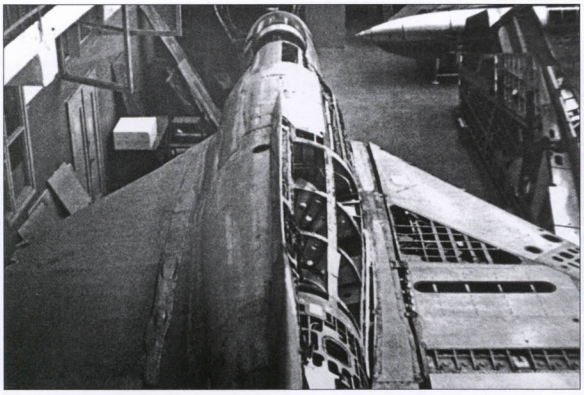
Ye-8F fighter (project)

In 1963 the Mikoyan OKB developed yet another version of the fighter designated Ye-8F (*for**see**rovannyy* – uprated). This version, which likewise remained on the drawing board, was to have short take-off and landing (STOL) capability, being equipped with several lift engines developed by the Rybinsk-based OKB-36 under Pyotr A. Kolesov. (See also next entry.)

MiG-21PD STOL technology demonstrator (Ye-7PD, *izdeliye* 23-31, *izdeliye* 92)

In the mid-1960s two of the Soviet 'fighter makers' – the Sukhoi and Mikoyan bureaux – began experimenting with STOL aircraft. At the time the Sukhoi OKB was working on the T-58 interceptor (the future Su-15 *Flagon*) and the T-6 tactical bomber (the future Su-24 *Fencer*), while the Mikoyan OKB was developing the MiG-23 *Flogger* tactical fighter. Both design bureaux opted for the same solution of the STOL capability task, choosing a mixed powerplant with one or two cruise engines and several lift engines buried in the fuselage. By then a suitable engine – the 2,350-kgp (5,180-lbst) RD36-35 turbojet – had been developed by OKB-36.

OKB-155 envisaged two alternative layouts for the MiG-23 STOL fighter. One of the projected versions, known in house as *izdeliye* 23-01, was a fairly conventional aircraft featuring a tailed-delta layout with mid-set wings and semi-



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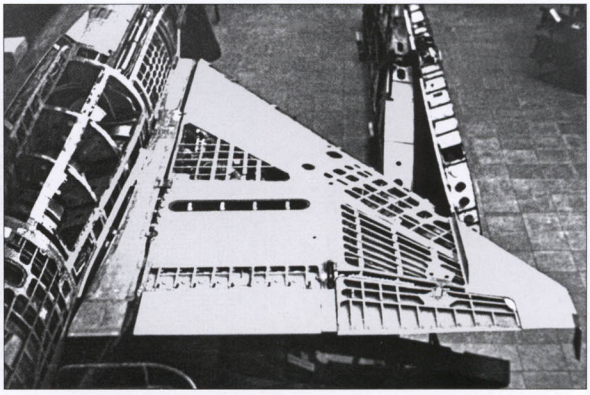

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After retirement the Ye-7PD was used by the Moscow Aviation Institute as an instructional airframe. Here it is still substantially complete.

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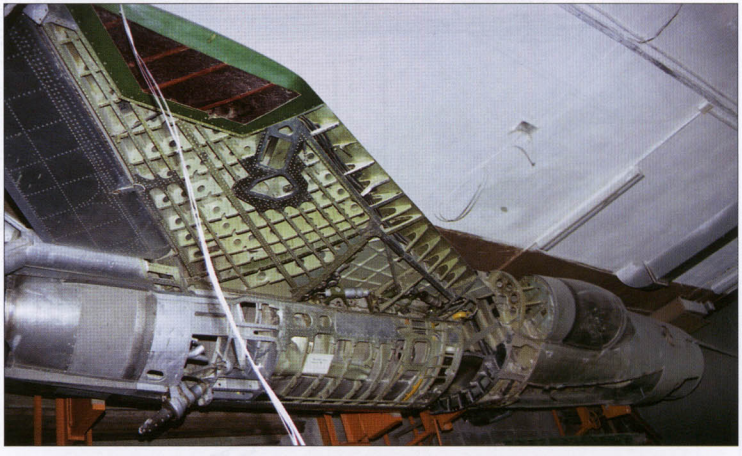
The same aircraft in later days; only fragments remain and the centre fuselage with the lift engine bay is gone



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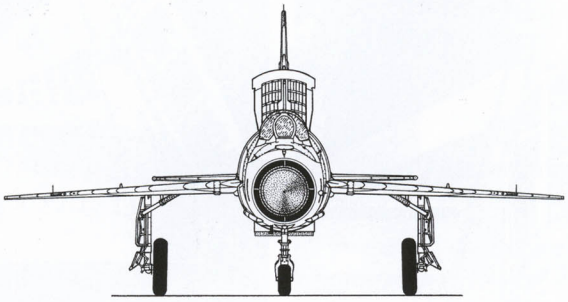
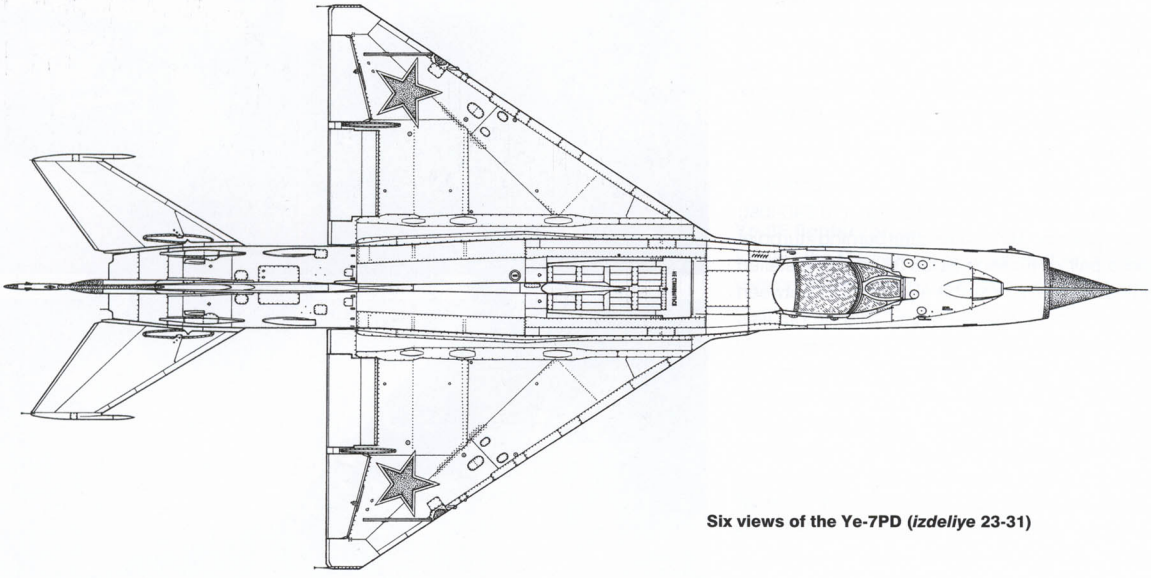
circular lateral air intakes with centrebodies. It was powered by one 8,500-kgp (18,740-lbst) Khachatoorov R27F-300 afterburning turbojet and a pair of Kolesov RD36-35 lift-jets installed almost vertically near the aircraft's CG between the cruise engine's inlet ducts. This aircraft was code-named *Faithless* by NATO and erroneously referred to as the MiG-23PD (*pod**yom**nyye **dvig**ateli* – lift engines). The other version, *izdeliye* 23-11 (the *Flogger* prototype), had an R27F-300 with two-dimensional intakes but lacked lift engines; instead, STOL capability was obtained by using shoulder-mounted variable-sweep wings. In order to speed up development of the *izdeliye* 23-01 the Mikoyan OKB decided to build a propulsion testbed/STOL technology demonstrator based on the MiG-21 for verifying the RD36-35 lift-jets.

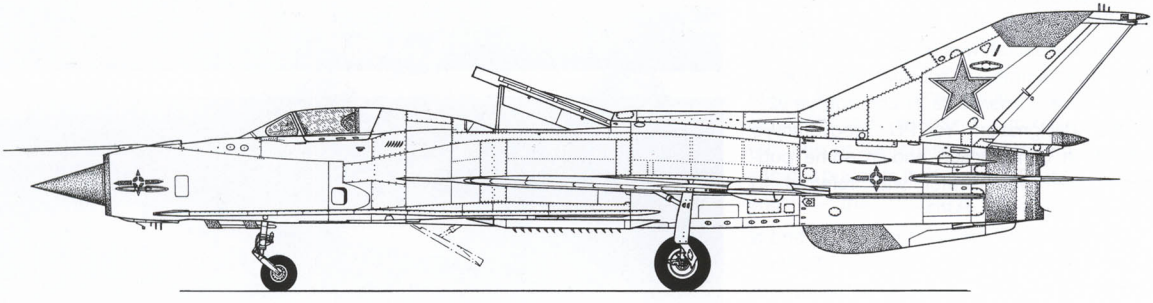
The demonstrator was built by extensively converting a production MiG-21PFM (*izdeliye* 94). Since the aircraft was developed under the MiG-23 programme, it sported two product codes at once – *izdeliye* 23-31 and *izdeliye* 92 – and the designation Ye-7PD (*podyomnyye dvigateli*). In conversation and in some publications the demonstrator was referred to unofficially as the MiG-21PD.

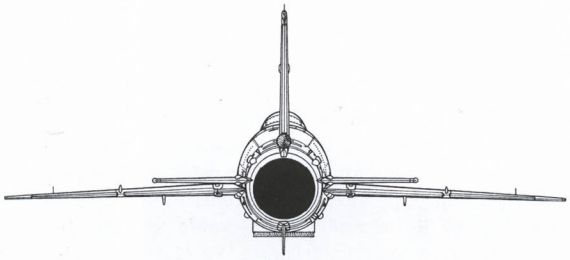
The MiG-21PFM airframe was cut up and a 900-mm (2 ft 11⅞ in) 'plug' of greater diameter was inserted into the fuselage. As in the case of the *izdeliye* 23-01, the two lift engines were mounted in tandem and tilted slightly forward (their axes were at 85° to the fuselage waterline).



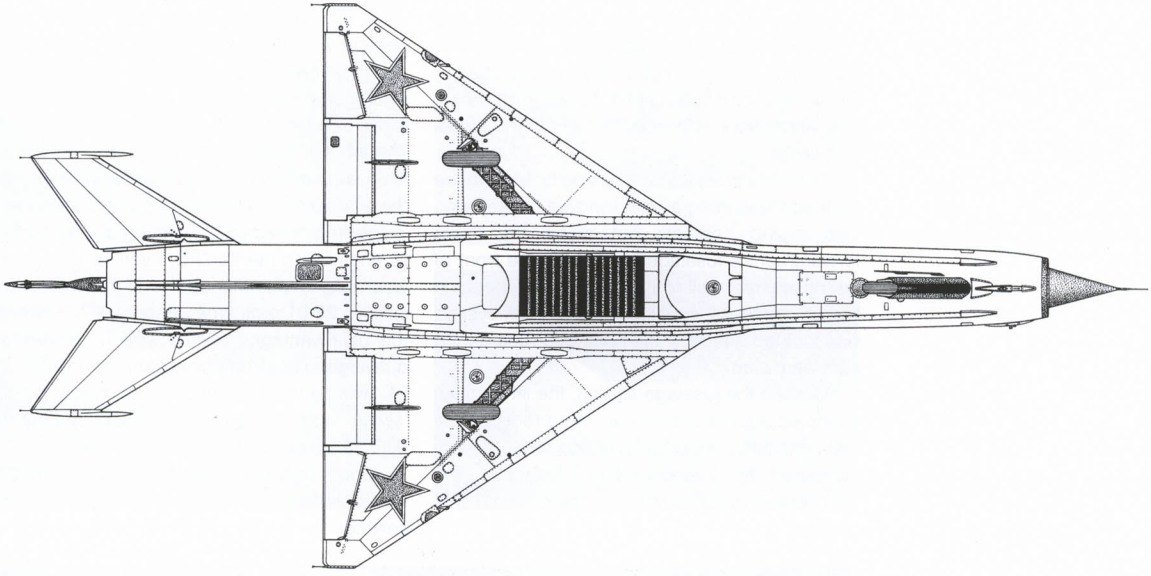


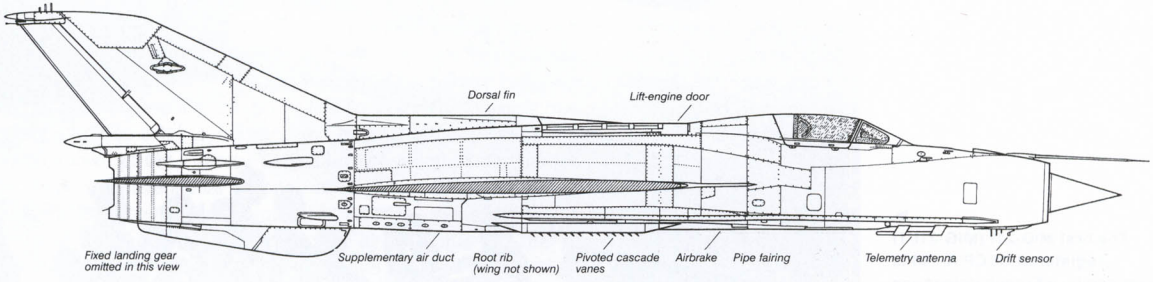
Six views of the Ye-7PD (*izdeliye* 23-31)





Fixed landing gear omitted in this view





During take-off and landing they breathed through a hydraulically actuated aft-hinged intake door incorporating 16 spring-loaded suction relief doors located four-abreast. Hence the fuselage spine was replaced by a short fairing aft of the cockpit terminating immediately ahead of the lift engine bay. The lift engines exhausted through a rectangular aperture in a flat-bottomed bulge on the centre fuselage underside. This aperture had swivelling deflector vanes enabling the pilot to vector the thrust of the lift-jets 10° aft for take-off and 5° forward for landing to reduce the landing speed. The cruise engine was a Tumanskiy R13F-300 rated at 6,400 kgp (14,110 lbst) in full afterburner.

Since the cruise engine's inlet ducts circumventing the lift engine bay left no room for the mainwheel wells, the Ye-7PD had a fixed landing gear. However, the demonstrator was not intended for high-speed flight and there was no need to retract the gear anyway. Because of the wider-than-usual centre fuselage to which the wings were attached, the wheel track was also wider.

The vertical tail featured a long fin fillet whose front end was integral with the said intake door. Two piping conduits ran along the lower forward/centre fuselage sides from the front of the nosewheel well to the rear of the lift engine bay. A 'towel rail' aerial for the data link system was located ahead of the nose gear unit on the starboard side.

Despite the fuselage stretch, the lift engines occupied a lot of space, causing a reduction in fuel capacity, not to mention the greatly increased fuel consumption. Therefore the Ye-7PD's endurance was no more than 15-17 minutes.

The Ye-7PD (*izdeliye* 23-31) made its first flight on 16th June 1966 with Pyotr M. Ostapenko at the controls. Another Mikoyan OKB test pilot, Boris A. Orlov, also took part in the demonstrator's flight tests. The test programme went ahead successfully, and it was even deemed advisable to show the aircraft publicly. On 9th July 1967 the Ye-7PD demonstrated its short-field capability at the impressive airshow held at Moscow-Domodedovo airport.

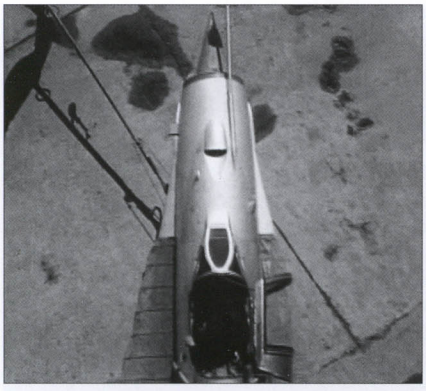
Boris Orlov had the following recollections of the Ye-7PD. *'Taking off and landing in this aircraft was not easy. At ground level the efflux of the lift engines spread out in all directions, creating a suction effect that reduced the wing lift. The influence of the lift jets both on overall lift and on the aircraft's stability and handling varied, depending on the speed and altitude. While there were few problems on take-off (only a slight change in longitudinal trim which was easily counteracted after becoming airborne), on landing this suction effect caused the aircraft to lose altitude fast and decelerate sharply. Therefore it was necessary to accelerate the main engine to full military power or even engage the afterburner immediately before touchdown.'*

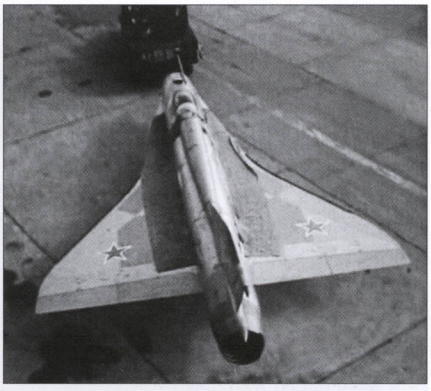
Having mastered the piloting of a fighter with lift engines on the Ye-7PD, Pyotr M. Ostapenko was able to commence the flight tests of the *izdeliye* 23-01 prototype in April 1967. However, the disadvantages of this type of powerplant outweighed its strong points and the *izdeliye* 23-01 was quickly abandoned in favour of the 'swing-wing' *izdeliye* 23-11, which became the MiG-23S in production form.

Upon completion of the tests the Ye-7PD was donated to the Moscow Aviation Institute, serving as a cutaway instructional airframe.

Yefim Gordon archive

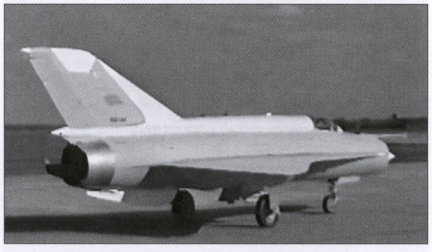
▶ **The first MiG-21I (MiG-21I/1) registered CCCP A-144 is examined by a French delegation visiting the USSR as part of the Soviet-French cooperation during the development of the Tu-144 supersonic airliner.**





◀ **The MiG-21I/1 is towed, showing off its tailless-delta layout and the ogival wings.**

◀ **MiG-21I CCCP A-144 is prepared for a flight, with Su-11 and Su-15 interceptors in the background.**



◀ **CCCP A-144 taxies out for take-off.**

All photos Yefim Gordon archive

Sadly, this unique aircraft did not survive; only parts of the airframe are still in existence.

MiG-21I supersonic transport technology demonstrator (*izdeliye* 21-11, Analogue)

In the mid-1960s the Soviet aircraft industry was busy with another high-priority and highly prestigious programme – the Tupolev Tu-144 *Charger* supersonic transport (SST). The Tu-144 utilised a tailless-delta layout, and the original version known at the Tupolev OKB as *izdeliye* 044 had unconventional wings of ogival planform. Before the first prototype Tu-144 registered CCCP-68001 could take to the air, a lot of the features embodied in its design had to be verified. In particular, it was necessary to check the stability and handing of the ogival-wing, tailless-delta aircraft in all flight modes. Hence MAP deemed it necessary to build a subscale proof-of-concept vehicle based on the production MiG-21 fighter. This aircraft would be used for checking out the new wing design in flight and for developing the optimum piloting techniques.

The head office in Moscow (OKB-155) was not in a position to do the job, having higher-priority programmes for the Air Force and the PVO to take care of. Therefore, development of the Tu-144 technology demonstrator was entrusted to the special design office of the Gor'kiy aircraft factory No. 21. An MAP order to this effect was issued on 1st August 1964. At OKB-155 the programme was supervised by I. V. Froomkin, while Ye. I. Mindrov (head of the special design office) headed the design effort in Gor'kiy. The scientists M. Taïtz, A. Mironov and V. Grachov, as well as project engineer V. Startsev (representing LII), participated

actively in drawing up the specifications to which the technology demonstrator would be designed.

The demonstrator was officially designated MiG-21I (for *imi**tah**tor* – 'simulator', that is, in-flight simulator) and bore the in-house product code *izdeliye* 21-11. Unofficially the machine was known as the ***Ana**log* (Analogue); this was a reference to its similarity to the Tu-144 in layout and wing planform. Some sources erroneously referred to the aircraft as the 'A-144', which supposedly stood for 'analogue of the Tu-144'.

The machine was based on the production MiG-21S. The fighter's fuselage and landing gear were mated with new thin wings of ogival planform; changes were made to the control system, and the armament, weapons control system and part of the equipment were deleted.

Thus, much of the airframe had to be designed from scratch; also, appropriate modifications had to be made to the fuselage and the aircraft systems. The Gor'kiy aircraft factory's design office prepared the blueprints for the new airframe components and equipment items in 1965-66; N. A. Limanov was the aircraft's project chief.

Since the MiG-21I's wings represented a scaled-down version of the *izdeliye* 044's wings, the design team made use of the Tu-144 blueprints supplied by Andrey N. Tupolev's OKB-156. A wind tunnel model of the MiG-21I was tested at TsAGI; this made it possible to determine the machine's principal aerodynamic parameters in all flight modes and issue recommendations for the test pilots long before the demonstrator actually flew.

The new wings had a gross area of 41.1 m² (442.4 sq ft) and an aspect ratio of 1.62. The leading-edge sweep was 78° on the root portions or leading-edge root extensions (LERXes) and 55° on the outer portions; the LERXes extended forward almost as far as the air intake lip, the port LERX blending with the AoA sensor fairing on the side of the nose. The wings utilised a thin symmetrical airfoil with a sharp leading edge; the thickness/chord ratio varied from 2.3% to 3.5%.

There were no high-lift devices. The entire trailing edge was occupied by two-section elevons; each section had its own actuator enclosed by an elongated fairing on the wing undersurface. All four sections moved in concert when the control stick was moved back and forth; when it was moved from side to side the elevons deflected differentially. The elevons' travel limits were +7°/–20° in elevator mode and +15°/–28° in aileron mode. The rudder had a maximum deflection of ±25°; all control surfaces were operated by irreversible hydraulic actuators.

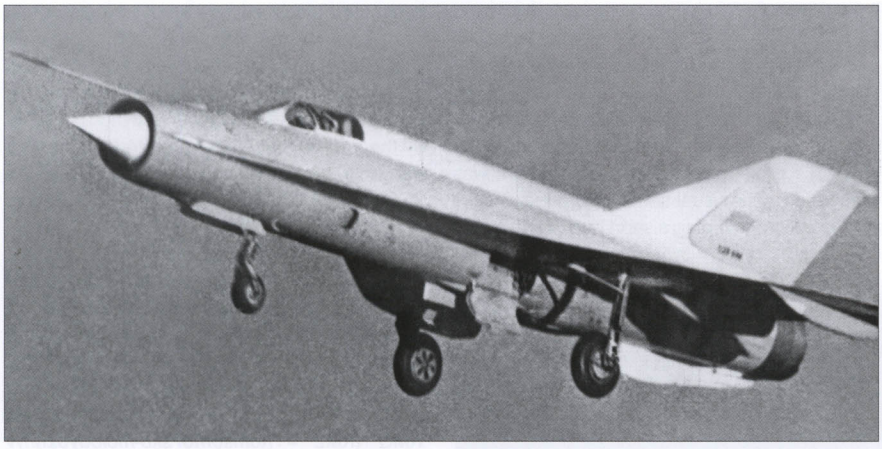
The pitch control circuit incorporated a device allowing the pilot to select the stick-to-elevons gearing ratio between 0.735 and 1.59. The roll control circuit featured a non-linear ratio between stick travel and elevon travel, just like on the MiG-21S. Spring-loaded artificial-feel devices were provided to emulate the aileron and elevator forces on the stick. The control system included a three-channel (pitch/roll/yaw) damper which could be selected on or off in flight. With the damper in operation, the elevon and rudder deflection limits were ±0°30' in the pitch channel, ±1°12' in the roll channel and ±4° in the yaw channel.

As compared with the standard MiG-21S, the fuselage of the MiG-21I was 0.75 m (2 ft 5 17/32 in) shorter; in contrast, the wing span was 60% greater. The Analogue was powered by an R13F-300 turbojet delivering 6,490 kgp (14,310 lbst) in full afterburner. The six bladder tanks in the fuselage and the integral wing tanks held a total of 3,270 litres (719.4 Imp gal); the aircraft was also able to carry a standard 490-litre (107.8 Imp gal) drop tank on a centreline pylon.

Three examples of the MiG-21I (two flying prototypes and a static test airframe) were built; interestingly, the prototypes were completed with almost two years between them. The airframes were largely manufactured in Gor'kiy, with the exception of the wings, which were 'subcontracted out' to aircraft factory No. 64 in Voronezh. The reason for this was that plant No. 64 was due to commence series production of the Tu-144 shortly and had to master the structurally complicated ogival wings, which were quite difficult to manufacture; building the MiG-21I wing panels would give the plant its 'first taste' of the design.

Final assembly of the first prototype (which, somewhat surprisingly, bore the c/n N010104 – that is, Batch 01, 04th aircraft in the batch) took place in Moscow at MMZ No. 155. The second prototype (c/n N010103) and the static test article were assembled in Gor'kiy. (Oddly, regarding the last digits of the construction numbers, there appears to be 'one c/n too many'; yet the c/ns of the two prototypes are confirmed both by official documents and by photo proof. It remains unclear whether the static test article was c/n N010101 or N010102.)

The first prototype (MiG-21I/1) was finished in two shades of grey (the fuselage spine, fin leading edge and brake parachute housing were painted a lighter colour). Unusually, the machine sported a Soviet flag and the non-standard



◄
MiG-21I CCCP A-144 on final approach.

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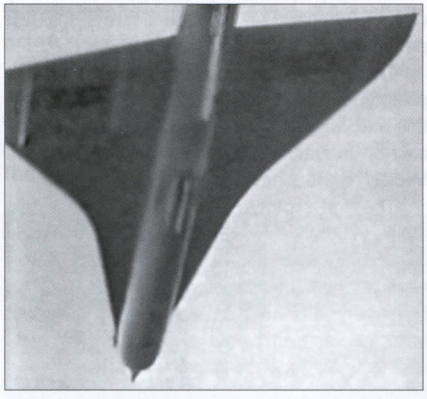
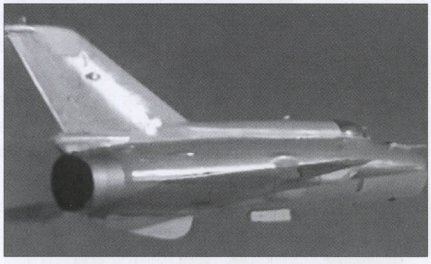
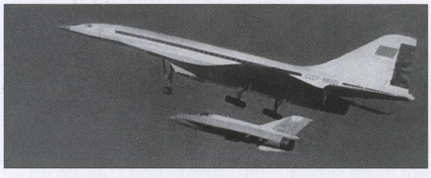
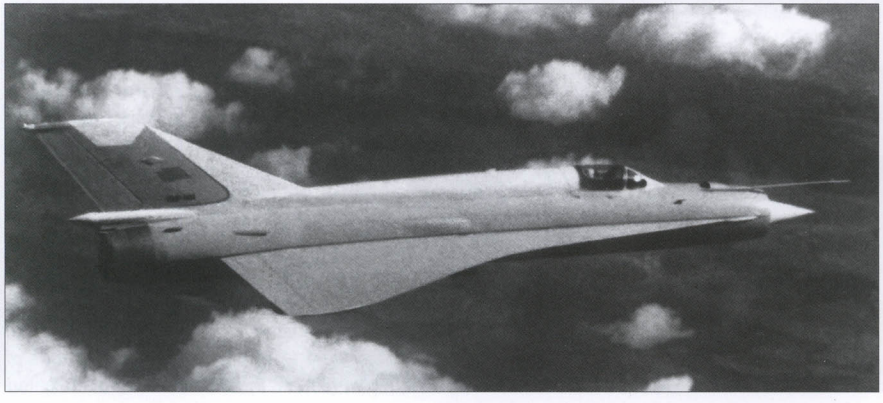
More in-flight shots of the MiG-21I/1 – probably taken from the cabin of the Tu-144.

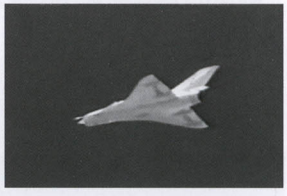




CCCP A-144 flies chase for the first prototype Tu-144, CCCP-68001, in early 1969.
▼◄







◄ ▲
More views showing the MiG-21I's wing shape and the ventral elevon actuator fairings.

All photos Yefim Gordon archive

alphanumeric civil registration CCCP A-144 (*sic* – with the hyphen in the wrong place) on the tail and the wing underside in lieu of the normal star insignia. On 18th April 1968 the aircraft took off on its maiden flight at the hands of LII test pilot Oleg V. Goodkov, who had been appointed the MiG-21I's project test pilot. The first flight was preceded by the usual series of ground checks and taxi tests, including a short hop to an altitude of 1-2 m (3-6 ft). It was during this hop that Goodkov discovered that the Analogue was reluctant to land; the aircraft bounced several times as the pilot tried to bring it down to terra firma. The pilot and the specialists involved in the tests were worried at first, but the reason turned out to be simple – the large wings created an air cushion effect that increased wing lift appreciably as the aircraft approached the runway surface. At a session of MAP's Methodical Council that was to give the go-ahead for the maiden flight, LII specialists demanded that a second short hop should be made before the first real flight could be attempted. Still, Goodkov got his way and obtained permission for the flight – and the flight went quite successfully, with nothing untoward. By the end of 1968, when Tu-144 CCCP-68001 was due to commence flight tests, MiG-21I CCCP A-144 had made 64 flights; 57 of them were performed by Goodkov.

RSK MiG

▲ **A 'toad's eye view' of the MiG-21I/1 showing the straight LERXes.**

A side view of the same aircraft. ▼

RSK MiG

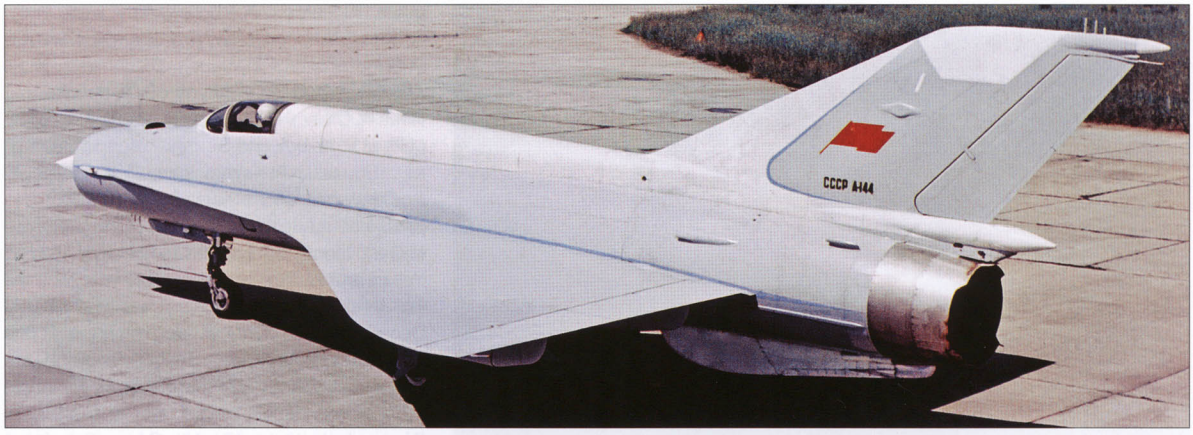
The second flying example (MiG-21I/2) was not completed until the end of 1969. It was painted silver overall and wore Air Force insignia but no tactical code. Instead, the aircraft sported photo calibration markings and proudly wore the *Komso**mol*** (Young Communist League) badge on both sides of the nose, along with the legend 'КМЭ' (КМЕ = *Komso**mol**'sko-molo**dyozh**nyy eki**pazh*** – Komsomol youth crew).

It was decided that the aircraft would make its first flight from Gor'kiy-Sormovo (the factory airfield of plant No. 21). To this end a support team headed by engineer I. Zhidenko was dispatched from Moscow. The team also included V. Startsev (the engineer in charge of the second prototype's tests) and Igor' P. Volk, a young LII test pilot who was appointed this machine's project test pilot. Upon arrival they were joined by I. V. Froomkin, the MiG-21I project chief at OKB-155.

The MiG-21I/2 differed from the first prototype in several respects. Preparations for this machine's first flight were completed at the end of January 1970, and soon Volk flew the MiG-21I without any trouble.

The first prototype, the bulk of whose test flights took place in 1968-69, served for evolving the techniques of piloting a tailless-delta aircraft controlled by means of elevons. The second prototype, whose test programme at LII began in 1970, served for aerodynamic experiments and was subjected to modifications. In particular, the original straight LERXes with 78° leading-edge sweep were replaced by scimitar-shaped ones. A cigar-shaped pod housing a cine-camera was installed at the tip of the fin and a small fairing housing a second cine-camera pointing to starboard was added to the fuselage spine. The cine-cameras served for capturing the airflow pattern on the wings in various flight modes; to this end the starboard wing was covered with wool tufts. Additionally, the upper and lower surfaces of the wings were rigged with air pressure sensors (pitot heads and static ports) and a laser system visualising the airflow over the wings was fitted.

The MiG-21I reached a maximum altitude of 12,000 m (39,370 ft) and was flown at indicated



RSK MIG

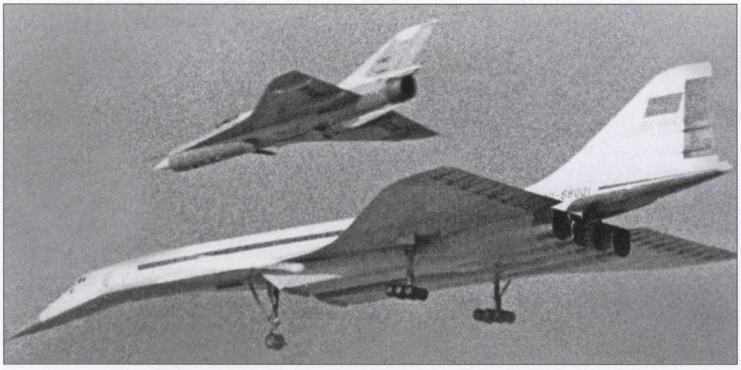
airspeeds from 212 km/h (131 mph) at 3,000 m (9.840 ft) to 1,205 km/h (748 mph) at 11,500 m (37,730 ft); it attained a maximum speed of Mach 2.06. The CG range in these flights was 40.2% to 47.7% MAC; the CG position was selected by installing special weights of 277-290 kg (610-640 lb) apiece in the nose or rear fuselage. The MiG-21I/1 had an all-up weight of 6,550-7,930 kg (14,440–17,480 lb) and had a wing loading of 160-193 kg/m² (32.8-39.5 lb/sq ft). The appropriate figures for the second aircraft were 6,260-7,640 kg (13,800-16,840 lb) and 152-186 kg/m² (31.16-38.13 lb/sq ft).

Large-scale flight tests with the MiG-21I were undertaken by LII jointly with the Tupolev and Mikoyan bureaux and TsAGI in 1968-72. The research was directed by I. M. Pashkovskiy, who was assisted by engineers in charge I. V. Froomkin (OKB-155) and V. Ya. Molochayev (LII); Oleg V. Goodkov was project test pilot. The results of these tests provided a virtually complete picture of a tailless-delta aircraft's flight dynamics and control characteristics within a wide range of AoAs and speeds (up to Mach 2). The machine's stability and control characteristics were determined, its handling in subsonic and supersonic flight at varying speeds and altitudes was assessed, and the aircraft's stall and spinning characteristics were explored. Additionally, a lot of aerophysical research was undertaken with the MiG-21I.

A total of 16 pilots made test and familiarisation flights in the Analogue. In addition to the ones mentioned above, they included LII test

▲
MiG-21I CCCP A-144 was finished in two shades of grey, with blue trim along the wing/fuselage joint line and the Soviet flag in typical 1960s 'flying' style. The registration was repeated on the underside of the wings. Note how the port LERX merges with the AoA sensor fairing. Note also the data link aerial aft of the nose gear unit.
▼

RSK MIG



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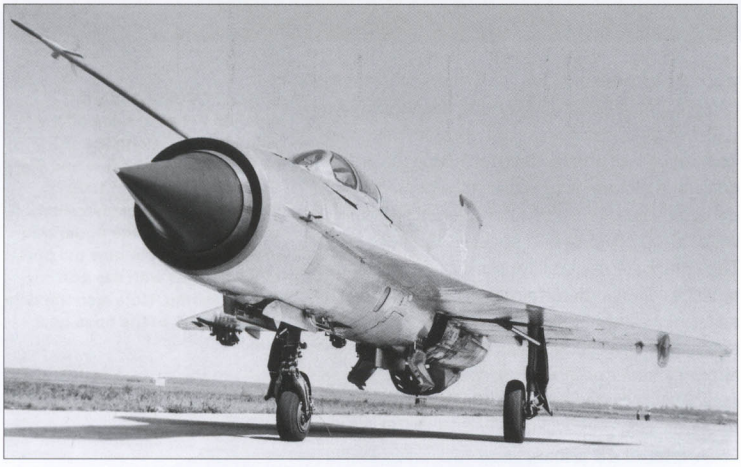
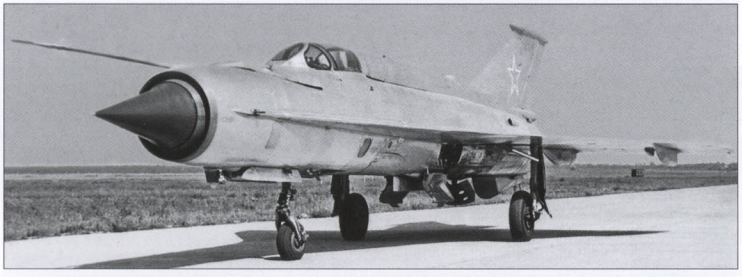


LII archive



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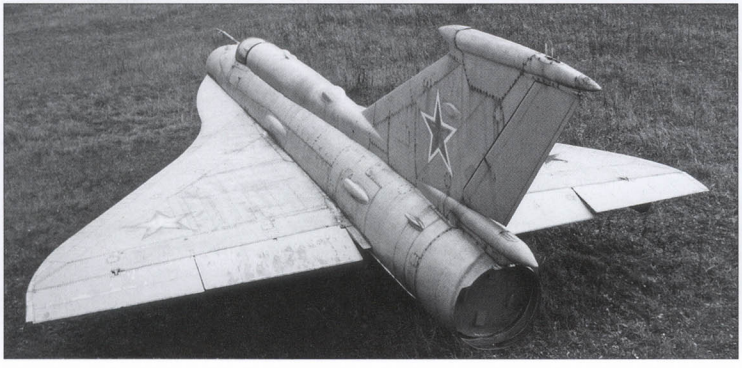


Yefim Gordon archive

pilots Aleksandr A. Shcherbakov and Viktor S. Konstantinov, GNIKI VVS test pilot Arkadiy P. Bogorodskiy, Mikoyan OKB test pilots Aleksandr V. Fedotov, Pyotr M. Ostapenko and Boris A. Orlov, MAP test pilots Eduard V. Yelian, Mikhail V. Kozlov and Sergey T. Agapov, as well as Eduard P. Knyaginichev, Vladimir V. Podkhalyuzin and others. By July 1969 these pilots had made 142 flights in the first prototype MiG-21I alone; eight of these were performed by Yelian and Kozlov, the very pilots who took the Tu-144 up into the air for the first time on 31st December 1968. Thus, among other things, the Analogue served as a trainer, allowing the aircrews of various MAP subdivisions (including the Tupolev OKB, the State Civil Aviation Research Institute (GosNII GA – *Gosoo**dar**stvennyy na**ooch**no-is**sled**ovatel'skiy insti**toot** grazh**dahn**skoy avi**aht**sii*), LII and the Voronezh aircraft factory) and GNIKI VVS to get ready for their first flights in the supersonic airliner. When the ogival-wing Tu-144 (CCCP-68001) entered flight test, MiG-21I CCCP A-144 was sometimes used as a chase aircraft. Eventually *izdeliye* 044 turned out to be a lemon and the Tu-144 had to be extensively redesigned. The resulting *izdeliye* 004 had double-delta wings and lots of other changes – but that's a different story.

The Analogue was fairly easy to fly and exhibited pleasant handling; hence it was popular with the pilots. The larger wings endowed the MiG-21I with high manoeuvrability; however, acceleration was slower compared with the production fighter. Eduard V. Yelian commented thus on the Analogue: *'I had flown straight-wing aircraft before, and I have to say that in take-off and landing mode swept wings have provided the pilot largely with a lot of inconvenience, such as all manner of stalls and oscillations. […] Well, at subsonic speeds the tailless MiG-21 derivative proved to be quite similar in handling to straight-wing aircraft; it possessed absolutely brilliant controllability. Its landing speed was around 220 km/h [136 mph] versus the MiG-21's 320 km/h [198 mph]. I had a*

▲▲◄
Another view of CCCP A-144 flying chase with the Tu-144 prototype. The MiG-21I is using the airbrakes to keep formation.

▲◄
The second flying MiG-21I had an overall silver finish and Air Force insignia.

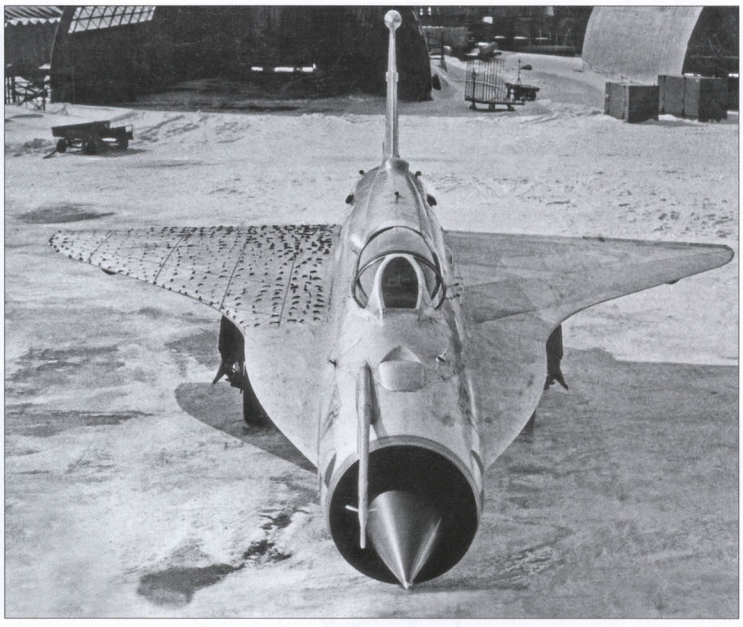
◄
This view of the MiG-21I/2 shows the new curved LERXes, the cigar-shaped fairing on the fin and the camera housing on the spine.

really good time flying the Analogue. Oh, there were a few minor complications in supersonic flight – the machine was prone to Dutch roll up to Mach 1.7, but that was easily corrected.' Boris A. Orlov noted that '…the aircraft was easy to fly on take-off and landing; it handled well during manoeuvres. During deceleration, however, as soon as the angle of attack reached a certain limit the aircraft would pitch up spontaneously, becoming unstable. Pushing the stick all the way forward gave no effect; the only option was to stall the machine by applying a bootful of rudder and then recover from the stall.'

Determining the relationship between the MiG-21I's lift coefficient and its angle of attack (especially at high alpha) turned out to be a tough task, as no calculation technique for this existed in the Soviet Union at the time. Such a technique was developed by a team of physicists at LII under the direction of laboratory chief V. Grachov and section chief Yu. Zavershnev. The results of the research flights depended to a large extent on the pilot who had to perform the deceleration (right down to stalling speed) strictly in accordance with the mission plan. He had to remember to switch on the test equipment at the right time and maintain radio contact with the cine theodolite measurement stations – all the while taking care not to exceed the AoA so as not to stall the aircraft prematurely. For safety's sake the spin was initiated at around 10,000 m (32,810 ft); this was important because, to complicate the matter, the MiG-21I was not fitted with spin recovery rockets which were incompatible with the tailless-delta layout. The results of the research were promptly forwarded to the Tupolev OKB.

After exploring the Analogue's entire speed and AoA range and meticulously performing all flight modes envisaged by the MiG-21I's test programme, Igor' Volk finally took the second prototype to stall mode and the aircraft flicked into a spin. After five turns of the spiral, Volk made a clean recovery and landed safely. The tests revealed that a tailless-delta aircraft with ogival wings retains high wing lift up to extreme angles of attack; moreover, the wing lift remains virtually constant.

Tragically, CCCP A-144 crashed fatally at Zhukovskiy when the main part of the test programme was already completed. On 28th July 1970 LII test pilot Viktor S. Konstantinov was flying the first prototype. At that time he was practising a display programme for the 1971 Paris Air Show where he was to fly a production MiG-21. That was to be the first appearance of a Soviet combat aircraft at a major international airshow; until then, Soviet participation in such events had been strictly civilian as a reflection of the Soviet Union's ostensibly peaceful foreign policy. Konstantinov had polished his display programme to perfection in a standard MiG-21 (well in advance of the event, it should be noted).



LII archive

▲
The MiG-21I/2 had wool tufts for airflow visualisation. Note the changing shape of the LERXes, the KME badge and the photo calibration markings.
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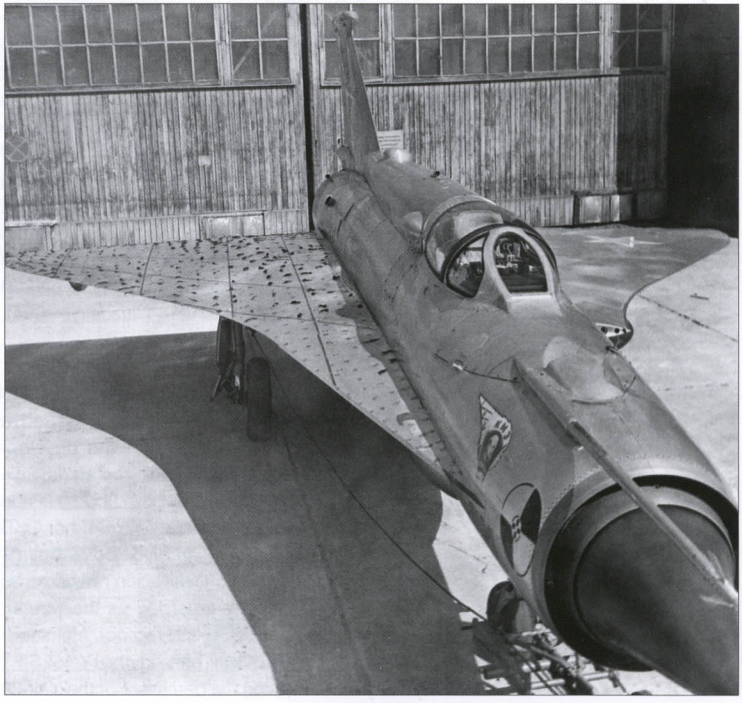

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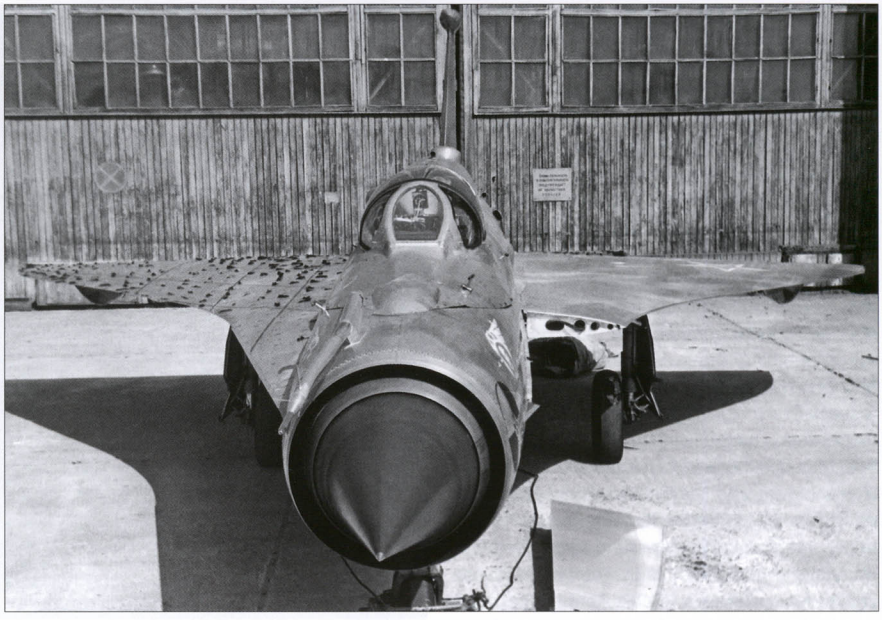


LII archive

Another view of the second MiG-21I in front of LII's hangar during modifications. The tufted starboard wing retains the original straight LERX, while the port LERX has been removed and is about to be replaced with a new scimitar-shaped section, which can be seen lying on the ground.

Now he decided to repeat it partly on the MiG-21I as he came in to land after a test mission and rashly started a series of aerobatic manoeuvres right above the runway – forgetting that the MiG-21I's handling was rather different from that of the standard tailed-delta fighter. One error on the part of the pilot was enough – the aircraft lost speed and started pancaking. The MiG-21I/1 impacted right in the middle of the runway and exploded; Konstantinov ejected at the last moment but the altitude was too low for his parachute to open.

The tests continued on the surviving second example. Once the test and crew training programmes had been completed, the aircraft was donated to the Soviet Air Force Museum (now Central Russian Air Force Museum) in Monino. Curiously (and logically), it is parked next to a production Tu-144 (*izdeliye* 004), CCCP-77106.

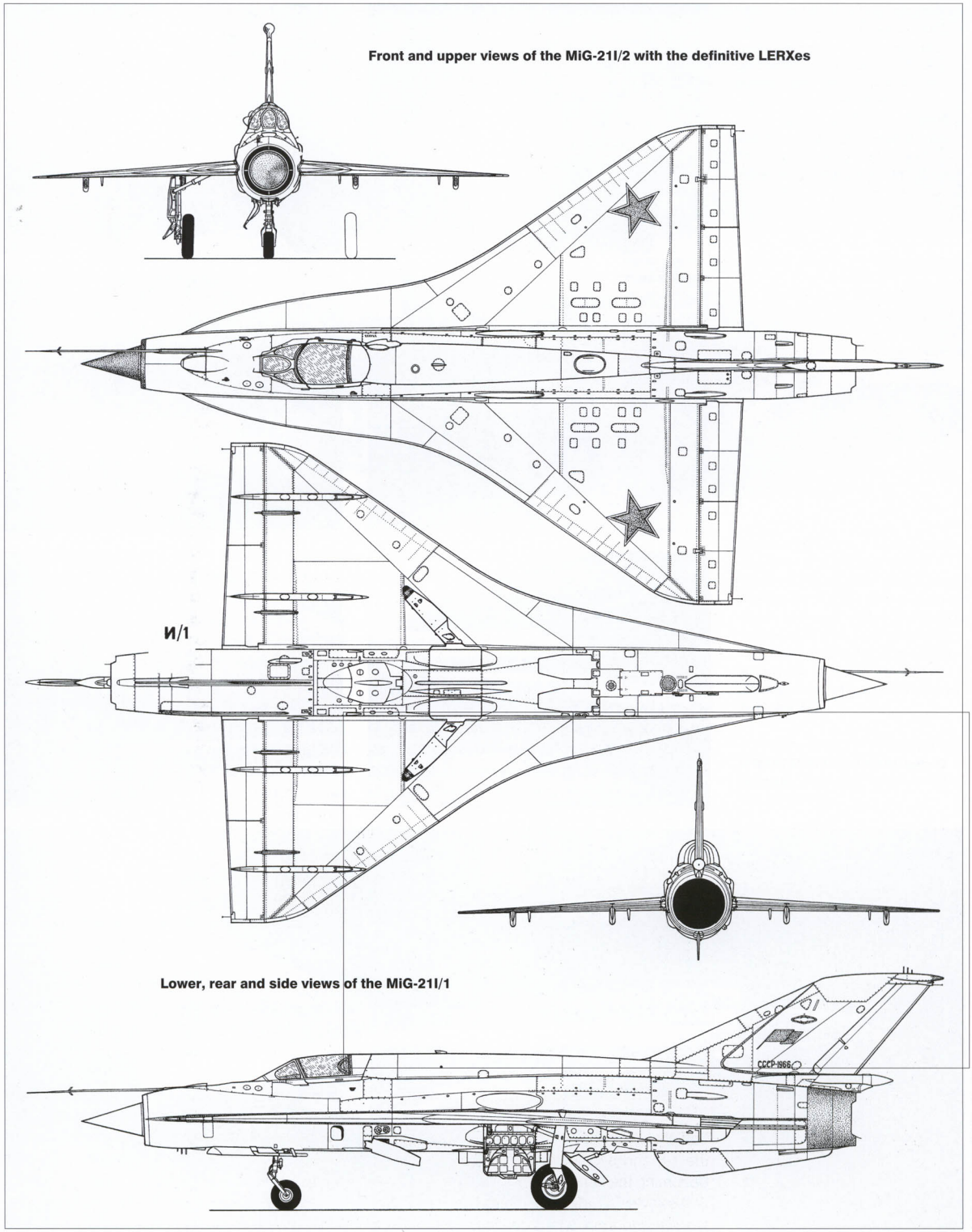
MiG-21K light attack aircraft (project)

In March 1969 the Soviet Air Force issued a request for proposals calling for the development of an advanced light attack aircraft (LSSh – ***lyoh****kiy samo****lyot****-shtoormo****vik***). Four design bureaux submitted their bids. The Sukhoi OKB put up the SPB project (*samo**lyot po**lya **boy**a* – battlefield aircraft), which was soon reworked as the T-8 and eventually emerged as the winner, becoming the famous Su-25 *Frogfoot*. Aleksandr S. Yakovlev's OKB-115 offered the Yak-LSh (***lyoh****kiy shtoormo****vik***) – a derivative of the Yak-28 Brewer tactical bomber with an armour-plated cockpit. OKB-240 led by Sergey V. Il'yushin submitted the IL-42 – a projected version of the IL-40 experimental attack aircraft. Finally, the Mikoyan OKB's offering was the MiG-21K project – a derivative of the MiG-21I tailless-delta technology demonstrator described above.

At a session of MAP's Scientific & Technical Council the projects were presented by General Designers Sergey V. Il'yushin, Artyom I. Mikoyan, Aleksandr S. Yakovlev and the Sukhoi OKB's Deputy General Designer Oleg S. Samoylovich. The result was rather surprising: MAP announced Phase 2 of the LSSh contest, barring Il'yushin and Yakovlev from it; only the Sukhoi and Mikoyan projects remained in the running. The two OKBs were required to build prototypes of the SPB and the MiG-21K.

The MiG-21K can best be described as a cross between the MiG-21I and the MiG-23B/MiG-27 fighter-bomber derived from the 'swing-wing' MiG-23; in fact, a wooden desktop model of the MiG-21K was actually marked '27 II', which presumably means 'MiG-27, layout No. 2'. The MiG-21I's ogival wings, vertical tail and R13F-300 engine were mated to a MiG-27-style drooped 'solid' nose affording the pilot a good downward view during the attack run. The engine breathed through two small lateral intakes in the wing roots terminating in line with the windshield.

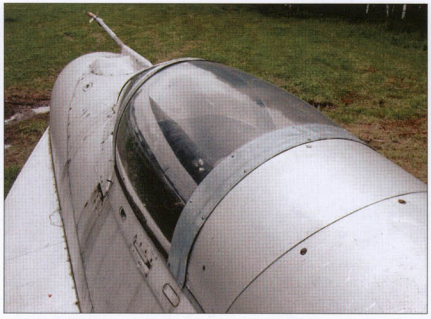
Assorted bombs and rockets, plus drop tanks, could be carried on six wing hardpoints;



Front and upper views of the MiG-21I/2 with the definitive LERXes

Lower, rear and side views of the MiG-21I/1

▶ **Detail views of the MiG-21I/2 on display at the Central Russian Air Force Museum in Monino. The shape of the wing leading edge is clearly visible. Note Tu-144 CCCP-77106 in the background – symbolically, the 'baby Tu-144' and the 'adult Tu-144' are parked together.**



Overall view of the MiG-21I/2 at Monino. ▼

All photos Yefim Gordon archive

All photos Yefim Gordon

◄▲
MiG-21SM '44 Red' served as an equipment testbed for the projected MiG-21DP UAV, being identifiable by the wiring conduit below the cockpit and the ventral fairing aft of the nose gear unit. It is seen on display at Moscow-Khodynka in 1989 (top) and at Zhukovskiy (left, with R-27R and R-73 AAMs).

A display model of the projected MiG-21K ('27 II') light attack aircraft based on the design of the MiG-21I.
▼

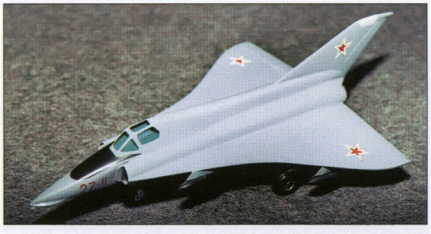
two of these were located under the wing roots/LERXes and the other four were arranged in pairs under the outer wings. The canopy was redesigned, the hinged portion opening upwards and aft *à la* MiG-23/MiG-27. To improve the aircraft's aerodynamics, small chines were added to the drooped nose, giving the aircraft a distinctive 'duck bill' look.

However, Phase 2 of the contest was never held because the Mikoyan OKB withdrew its bid, terminating the MiG-21K project. The reason was that a similarly modified ('duck-bill') strike version of the MiG-23 was much more promising; it would be more agile, offer much better field performance thanks to the variable-geometry wings and carry a bigger ordnance load. Also, the ogival-wing light strike aircraft concept failed to win support from TsAGI. Thus, the Sukhoi OKB won the contest by default, and the result was a first-rate combat aircraft (to give credit where credit is due!).

MiG-21Sh (MiG-27Sh, *izdeliye* 21-32) light attack aircraft (project)

In the late 1960s the Mikoyan OKB pursued several lines of development in its attempts to create a light tactical bomber and attack aircraft. As mentioned earlier, the first thing the designers did was to try adapting the MiG-21 fighter, which by then had been in production for nearly ten years, and the MiG-23 fighter, which had just entered production, for this role. One of several advanced development projects in the making at the time was designated MiG-21Sh (shtoormovik – attack aircraft); the machine bore the product code *izdeliye* 21-32.

Like the MiG-21K described above, the MiG-21Sh was a cross between the 'true' MiG-21 and the MiG-23B/MiG-27; the two designs were so intricately blended that it was hard to tell 'which aircraft had been grafted onto which', so to say. In fact, even the designers could not decide the issue. Hence, paradoxically, the aircraft was referred to alternatively as the MiG-21Sh and as the MiG-27Sh, and one of the display models was actually marked '27Sh'. Again, the aircraft had a MiG-27-style 'duck bill'



All photos Yefim Gordon

All photos Yefim Gordon

▲
A desktop model of the projected MiG-21Sh (alias MiG-27Sh). Obviously very little is left of the original MiG-21.

nose accommodating a target designator; the rear fuselage was similar to that of the MiG-21M/MiG-21*bis*, while the centre fuselage was all-new. The engine breathed through lateral air intakes which were outwardly similar to those of the MiG-27 but somewhat smaller and slightly raked in side view. The low-set wings had a complex planform (one might call them swept wings rather than delta wings); the wing area and wing span were increased to 31.45 m² (338.5 sq ft) and 8.86 m (29 ft 0 13/16 in) respectively. The wings had small LERXes and were fitted with leading-edge slats to improve manoeuvrability and increase the warload. The leading-edge sweep was 40° over the entire span; the trailing edge had a slight kink, with zero sweepback on the inboard portions.

A desktop model of the projected *izdeliye* 7-23 derivative of the MiG-21*bis* featuring new wings of reduced sweepback with LERXes and leading-edge flaps.
▼

All photos Yefim Gordon

The wings incorporated six hardpoints that could carry twice the ordnance load of the production MiG-21. A 23-mm (.90 calibre) twin-barrel cannon with depressable barrels was also envisaged; it could be brought to bear on ground targets in level flight.

The stabilator span was 3.74 m (12 ft 3¼ in); the vertical tail, including the ventral fin, was borrowed from the MiG-21 in as-was condition. The cockpit canopy and the fuselage spine were redesigned (again, the canopy was hinged at the rear). The nose gear unit had twin wheels.

A full-scale mock-up of the MiG-21Sh had been built by 1969. Yet, this project was also shelved for the same reason – the MiG-23B/MiG-27 offered higher performance.

MiG-21M light attack aircraft (project)

Another projected attack variant of the MiG-21 was, rather confusingly, designated MiG-21M (see Ye-8 section above and Chapter 4). It was to have lateral air intakes, lift engines giving STOL capability and a twin-wheel nose gear unit.

Rewinged MiG-21 (*izdeliye* 7-23) fighter (project)

The Mikoyan OKB contemplated a multi-role fighter based on the MiG-21*bis*. Known as *izdeliye* 7-23, it was to feature new wings of greater area and longer span with reduced leading-edge sweep, large cranked LERXes and leading-edge devices. The armament was to be carried on six wing pylons.

Rewinged MiG-21 (*izdeliye* 7-31) fighter (project)

Another projected derivative of the MiG-21*bis* designated *izdeliye* 7-31 likewise featured new delta wings of longer span with reduced leading-edge sweep. Unlike the *izdeliye* 7-23, the LERXes were quite small. The wings featured six weapons hardpoints, which allowed the fighter to carry three drop tanks and six AAMs – one on each inboard wing pylon and two R-60/R-60M or K-73 (R-73) short-range AAMs on paired launch rails on each outermost pylon.

Rewinged MiG-21 (*izdeliye* 7-33) fighter (project)

In 1976 the *izdeliye* 7-31 fighter evolved into a further project designated *izdeliye* 7-33. This aircraft was to have a more powerful engine – a single R-33 or R-69F afterburning turbofan.

MiG-21MB multi-role tactical fighter (project)

A projected version designated MiG-21MB incorporated the larger wings of the *izdeliye* 7-23

and certain equipment items created for the MiG-29 fourth-generation tactical fighter which was under development at the time. The MiG-21MB was to be powered by an Izotov R-33 (RD-33) afterburning turbofan rated at 8,300 kgp (18,300 lbst); the armament was to include a 30-mm (1.18 calibre) Gryazev/Shipunov GSh-301 cannon and new models of AAMs.

The fighter was to have a normal take-off weight of 9,000 kg (19,840 lb) and a maximum take-off weight of 12,500 kg (27,560 lb). The maximum speed was limited to 2,200 km/h (1,367 mph); the design range was 1,600 km (994 miles) and the ferry range was 3,000 km (1,863 miles). The ordnance load was increased to 4,000 kg (8,820 lb); typically the fighter was to carry eight AAMs – four R-3S missiles on individual launch rails and four R-60s or R-60Ms on twin launch rails.

MiG-21*bis* aerial minelaying version (project)
There were plans to develop a version of the MiG-21*bis* equipped for testing aerial minelaying systems. The aircraft was to carry Aldan, Amga and Viliuy mines (though named after Russian rivers, these were apparently anti-personnel mines).

MiG-21Zh high-altitude superfast interceptor (project)
One more project envisaged converting the MiG-21 into a high-altitude, high-speed interceptor with a cruise turbojet and a liquid-fuel rocket booster – a sort of 'Ye-50 revisited'. With the booster running, the aggregate thrust was to be 23,000 kgp (50,710 lbst). The total fuel load for the mixed powerplant was 10 tons (22,045 lb). Designated MiG-21Zh (the suffix referred to ***zhid****kosnyy reak****tiv****nyy* ***dvig****atel'* – liquid-fuel rocket motor), the interceptor had a design maximum speed of 4,400 km/h (2,734 mph) and a dynamic service ceiling of 40,000 m (131,230 ft); the combat radius was assessed as 450 km (279 miles).

'Soviet Starfighter' interceptor (project)
Evidence exists in the form of a desktop model that the Mikoyan OKB contemplated developing a fighter that bore a striking resemblance to the Lockheed F-104 Starfighter. The project dated back to the days when the MiG-21's general arrangement was being selected. The aircraft could be best described as a Starfighter without lateral air intakes and with a MiG-21F nose grafted on. The project proceeded no further than the proposal stage, and no designation is known.

***

In the 1960s and 1970s many Soviet aircraft design bureaux began actively developing unmanned aerial vehicles (UAVs) of various classes – mostly unmanned combat aerial vehicles (UCAVs) and reconnaissance drones. The Mikoyan OKB was no exception, launching the ***Kre****chet* (Gerfalcon) R&D programme, which was supervised by I. V. Froomkin. The results of the programme were incorporated in several UAVs based on the MiG-21 and the MiG-25.

MiG-21 UAV (*izdeliye* 21-12) (project)
One of the projected unmanned versions of the MiG-21 (*izdeliye* 21-12) was a high-altitude reconnaissance platform intended for carrying special optical systems.

MiG-21K UCAV (project, second use of designation)
The designation MiG-21K was later reused for a projected unmanned ground attack aircraft.

MiG-21DP UCAV (*izdeliye* 21-14) (project)
One more proposed version designated MiG-21DP (*distantsi****on****no pilo****tee****ruyemyy* [*le****ta****tel'nyy appa****raht***] – remotely piloted vehicle, RPV) or *izdeliye* 21-14 was actually an optionally piloted vehicle. In unmanned configuration it was to be used for delivering strikes against well-defended ground targets with known coordinates; if the anti-aircraft defences were weak or the need arose to redeploy, the MiG-21DP could operated as a conventional manned aircraft.

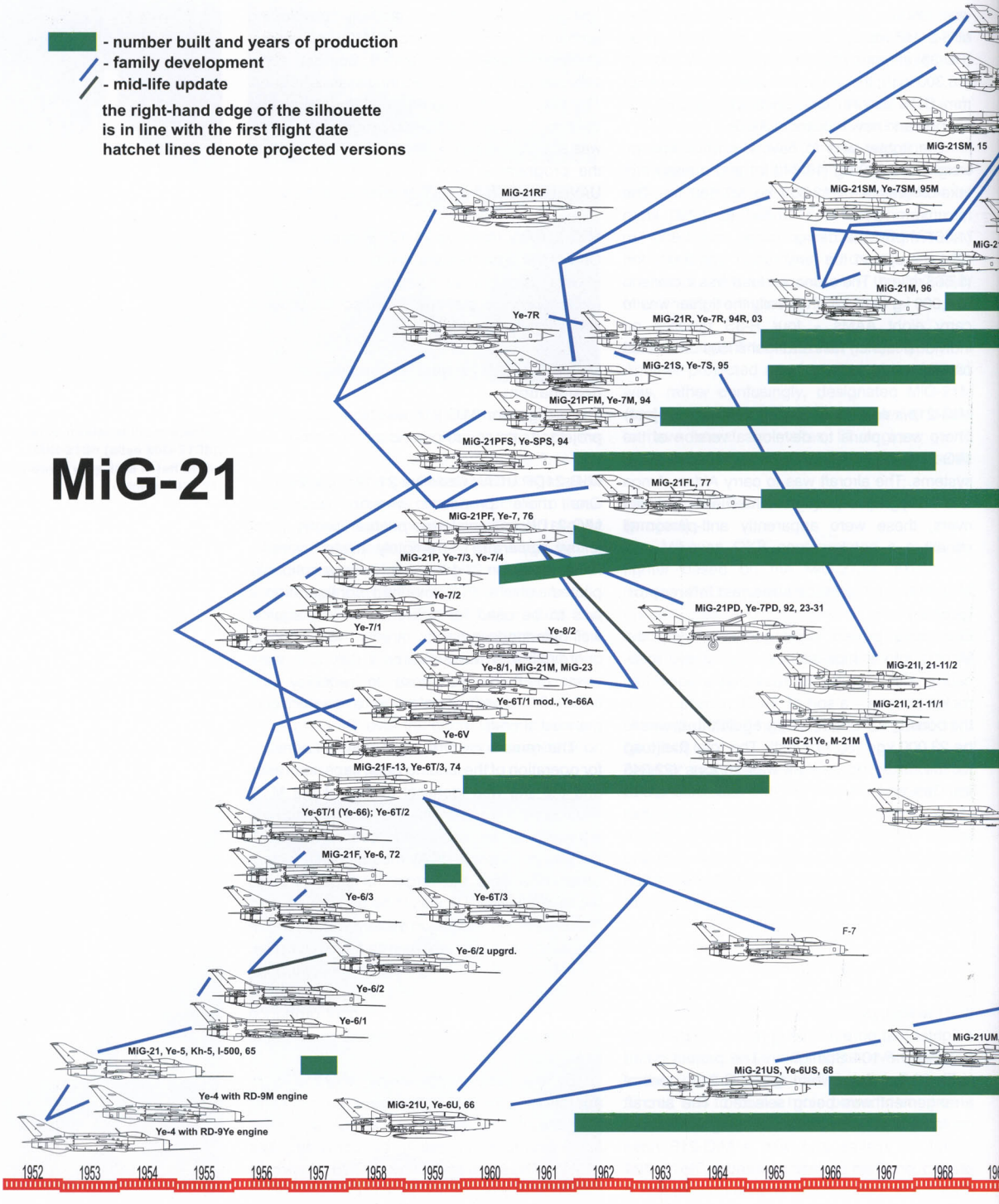
The remote control equipment responsible for operation of the landing gear, flaps, airbrakes and the like was identical to that of the M-21 (MiG-21Ye) target drone. To ensure accurate approach to the target and accurate weapons delivery (in reusable UCAV mode) or an accurate death dive onto the target (in cruise missile mode) the MiG-21DP was to be equipped with a Tercom inertial navigation system with a terrain-following feature, as well as with a new autopilot. In UCAV mode the aircraft would be capable of attacking multiple targets sequentially in a single sortie. For the sake of toting a bigger ordnance load the MiG-21DP was to operate at subsonic speeds only.

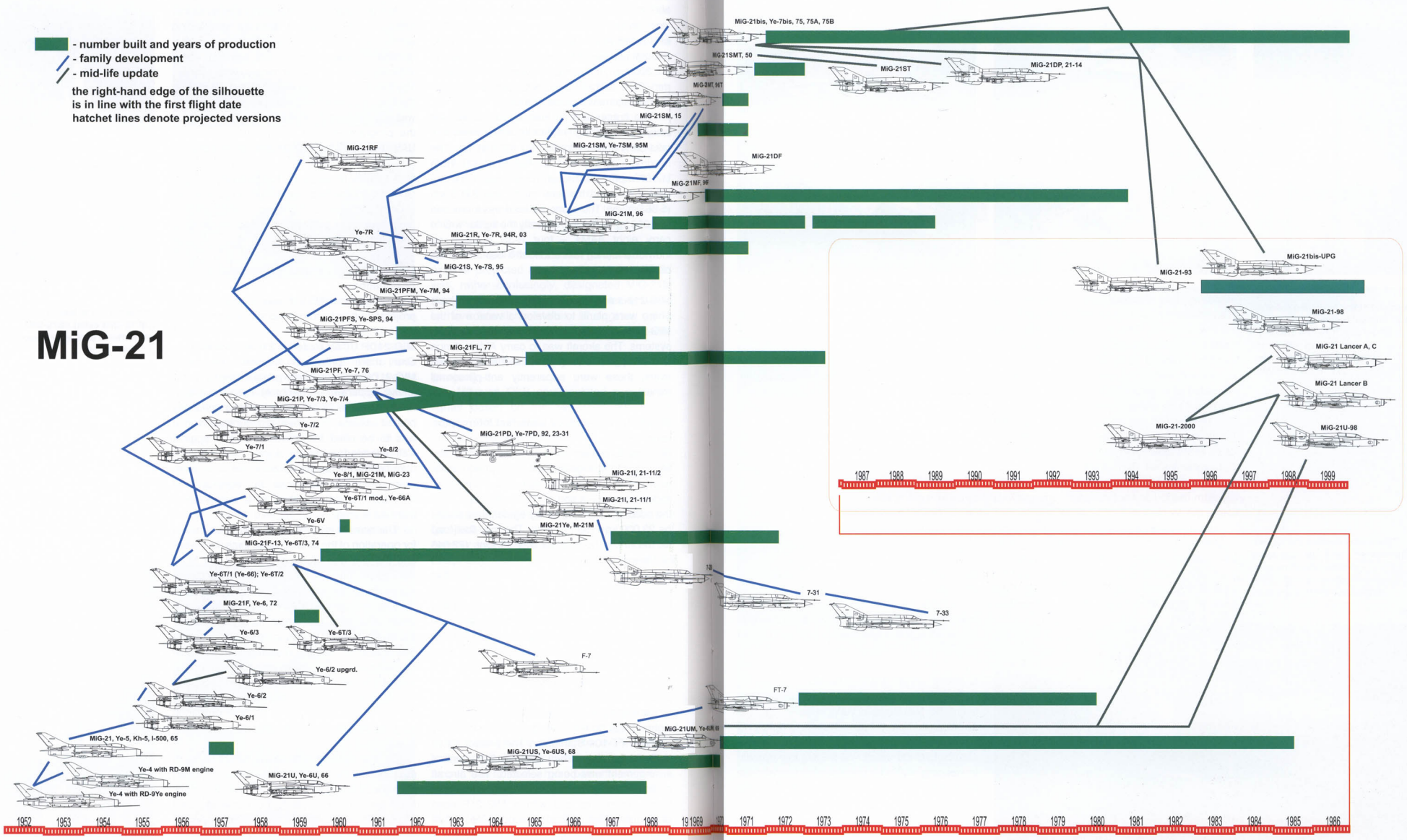
By the early 1980s many MiG-21s were approaching the limit of their service lives. Apart from the obvious application as target drones, such aircraft could easily be converted into UCAVs. Therefore the Mikoyan OKB developed the technology for converting high-time MiG-21s (in particular, MiG-21*bis* fighters) to MiG-21DP

MiG-21

- number built and years of production
- family development
- mid-life update

the right-hand edge of the silhouette is in line with the first flight date
hatchet lines denote projected versions




- number built and years of production
- family development
- mid-life update
the right-hand edge of the silhouette is in line with the first flight date
hatchet lines denote projected versions
MiG-21
MiG-21bis, Ye-7bis, 75, 75A, 75B
MiG-21SMT, 50
MiG-21ST
MiG-21DP, 21-14
MiG-21SMT, 96T
MiG-21SM, 15
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MiG-21RF
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MiG-21bis-UPG
MiG-21-93
MiG-21-98
MiG-21 Lancer A, C
MiG-21 Lancer B
MiG-21-2000
MiG-21U-98
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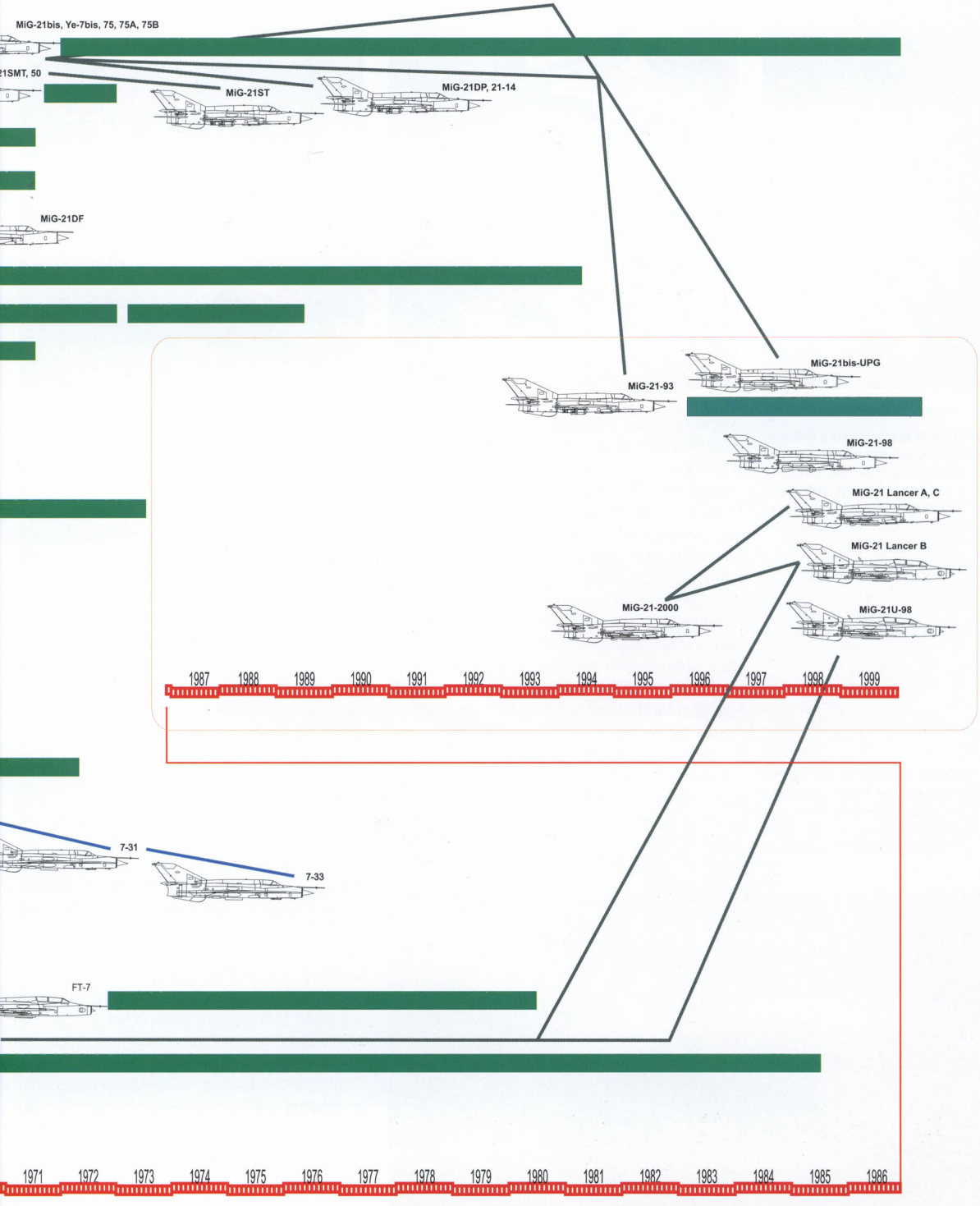

MiG-21bis, Ye-7bis, 75, 75A, 75B
21SMT, 50
MiG-21ST
MiG-21DP, 21-14
MiG-21DF
MiG-21bis-UPG
MiG-21-93
MiG-21-98
MiG-21 Lancer A, C
MiG-21 Lancer B
MiG-21-2000
MiG-21U-98
1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
7-31
7-33
FT-7
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986

▲
A model of the projected *izdeliye* 7-31 tactical fighter based on the MiG-21*bis*. The new wings of reduced sweep with small LERXes and six pylons are clearly visible.

standard. Two *Fishbeds* were converted into testbeds for the purpose of verifying the INS and the new autopilot. One of them was a MiG-21SM coded '44 Red'; this aircraft had the radar and cannon removed to make room for the new equipment. Part of the electric wiring had to be relocated to a large conduit running along the starboard side of the fuselage.

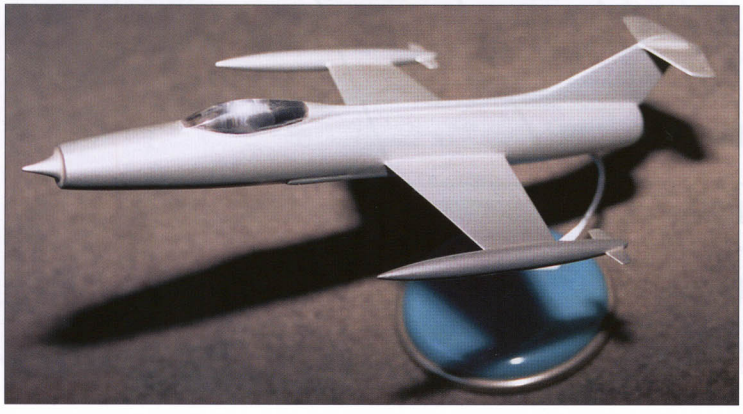
The modified aircraft was shown publicly for the first time at the aviation display which took place at Moscow-Khodynka in late August 1989. Subsequently '44 Red' appeared in the static park at the MosAeroShow '92 with R-27R medium-range semi-active radar-homing AAMs under the wings.

Upon completion of the tests under the UCAV programme MiG-21SM '44 Red' found use in other research and test programmes. In particular, it served as a weapons testbed for the new R-73 'dogfight AAM'. At the Mikoyan OKB and its flight test facility the machine was unofficially called MiG-21K; the K suffix possibly referred to the Krechet programme but could just as easily be borrowed from the specific UCAV project.

The planned tests of the automatic (or remote-controlled) landing mode never began. Nor was any MiG-21 ever actually converted to a reconnaissance drone or a 'flying bomb' with a warhead.

In later years, the idea of converting time-expired MiG-21s to reconnaissance drones or UCAVs was dusted off again on several occasions. Several alternative automatic landing systems were considered, as were methods of enhancing bomb delivery accuracy in UCAV mode or terminal guidance accuracy in cruise missile mode by means of satellite navigation.

This model depicts the 'Soviet Starfighter' – an F-104 look-alike configuration that was considered very briefly at the MiG-21's PD project stage.
▼



All photos Yefim Gordon

MiG-21DP reconnaissance drone (*izdeliye* 21-14R) (project)

As noted above, the OKB considered the idea of using the MiG-21DP for unmanned reconnaissance missions. This version was designated *izdeliye* 21-14R (*raz**ved**chik*).

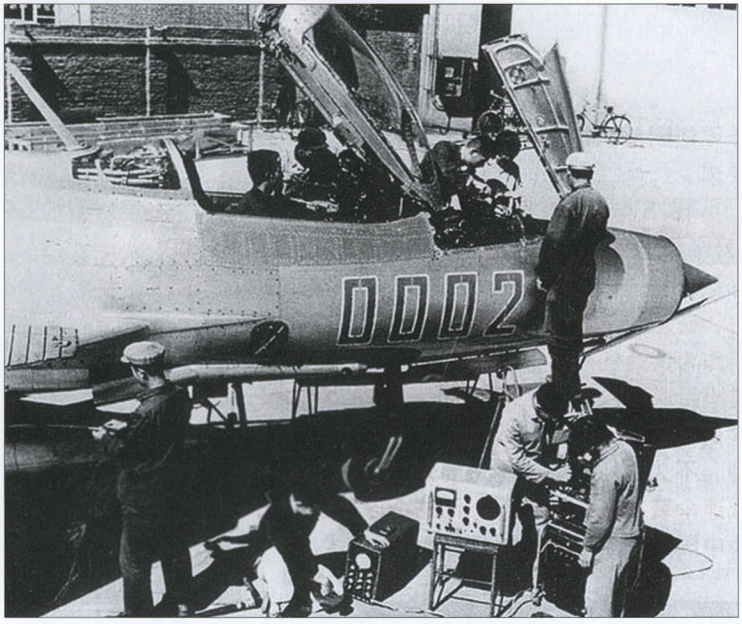
Q-MiG-21 target drone (project)

Russia was not the only nation to contemplate using the MiG-21 as a UAV. In early 1996 the American company Tracor Systems specialising in target drone conversions offered to convert surplus MiG-21Rs and MiG-21UMs into drones. In keeping with US practice the aircraft was advertised as the Q-MiG-21, the Q prefix denoting 'drone' (cf. McDonnell Douglas QF-4).

PART SEVEN

BEYOND THE GREAT WALL

via Internet



▲ **'0002 Red' was apparently the second Shenyang J-7. Here the fighter undergoes an avionics check.**

While Czechoslovakia was the first foreign manufacturer of the MiG-21, the People's Republic of China was the largest. In fact, on the other side of the Great Wall the MiG-21 started a new life; typically of the Chinese aircraft industry, new versions were developed that had no Soviet equivalent, and the latest Chinese offspring actually bear very little resemblance to their Soviet progenitor.

The licence-built MiG-21 and its family of indigenous versions became the most prolific aircraft to be produced in China. Curiously, the Chinese versions were almost as numerous as the Soviet ones but, unlike the latter, were derived almost exclusively from the original Ye-6 (MiG-21F/MiG-21F-13), not the 'big nose, big tail, big spine' Ye-7 that served as the basis for most of the Soviet variants.

J-7 '0003 Red' on display at the Beijing Military Museum. ▼

A.J.Walg

1. Single-seat versions

Shenyang J-7 Production Tactical Fighter (Product 62)

In early 1961 the Soviet Union granted China licence manufacturing rights for the MiG-21F-13 tactical fighter and its R11F-300 engine. In keeping with the licensing agreement three Soviet-built *Fishbed-Cs* were delivered to China as pattern aircraft, along with completely-knocked-down (CKD) kits for assembling an initial batch of 20 fighters. This was the first case on record when a super-power transferred state-of-the-art aviation technology, not outdated designs, to a third-world nation. (True, China was part of the communist bloc – the 'second world', – but the term 'third-world nation' is used here to reflect China's general lack of industrial infrastructure at that time.)

However, before the technology could be transferred in full, a rift occurred between Moscow and Beijing on ideological grounds in the mid-1960s. This escalated into outright armed conflict over several disputed islands on the Amur River forming the border between the Soviet Union and China, and all cooperation in defence technology matters between the two was broken off. Having an incomplete set of manufacturing documents and specifications, the Chinese nevertheless decided to press on and launch MiG-21 production no matter what.

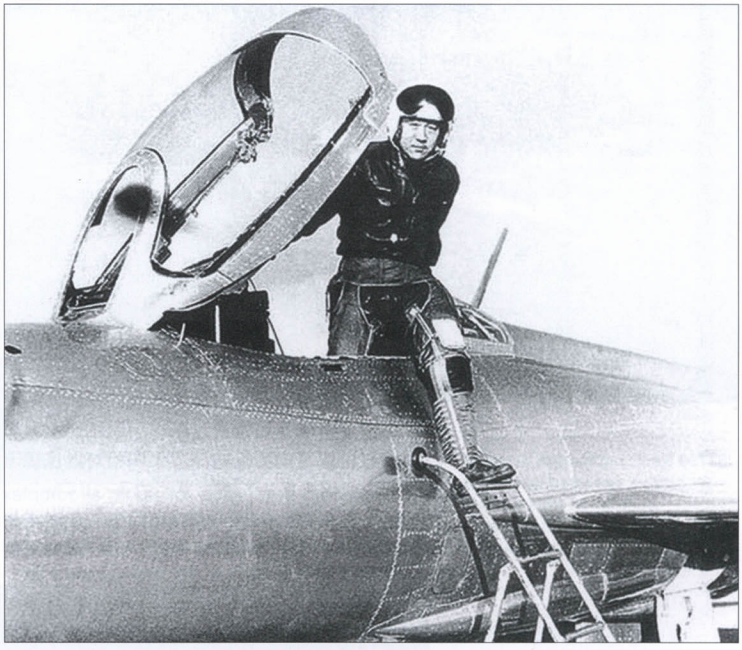
The Chinese claimed that the documentation that they *did* receive seemed to be full of deliberate (!) errors, which the Russians involved later vehemently denied. Their denial is believable. For one thing, it is normal practice for the aircraft designer (in this case, the Mikoyan OKB) to introduce a host of changes into the design and alter the manufacturing specs accordingly, especially in the case of such a complicated product as a modern jet fighter. For another, in pre-computer days the manufacturing documents came in the form of mountains of blueprints and paperwork. Some degree of discrepancies and errors is simply inevitable.

The aircraft factory in Chengdu situated in the centrally located Sichuan Province was selected to produce China's first second-generation jet fighter; this plant, which was

established in 1958, had been built with Soviet assistance. In keeping with the Chinese 'by role' aircraft designation system the MiG-21F received the local designation J-7, the J prefix denoting *jianjiji* (fighter) – that is, fighter, type 7. In early 1964 the Guizhou Aircraft Factory located down south in Guizhou (Canton), Kwangtung Province, started manufacturing J-7 airframe components, which were delivered to Chengdu for final assembly. (This plant is now known as GAIC – Guizhou Aircraft Industry Corporation; sometimes rendered as GAIGC – Guizhou Aircraft Industry Group Corp.) Meanwhile, the co-located Guizhou Engine Factory (now called LMC – Liyang Motor Corp.) was gearing up to manufacture the R11F-300 engine intended for the J-7; the licence-built version was designated WP-7 (for *wopen* – turbojet engine). Typically of a new product, production entry was beset by quality problems, and the 5,100-kgp (11,240-lbst) WP-7 initially had a time between overhauls (TBO) of no more than 100 hours.

Other equipment items and weapons, too, were copied under local designations. For instance, the reverse-engineered NR-30 cannon was known as the Type 30-1, while the K-13 AAM was copied as the PL-2; PL stood for *Pi Li* (Thunderbolt), which was a generic Chinese name for air-to-air missiles.

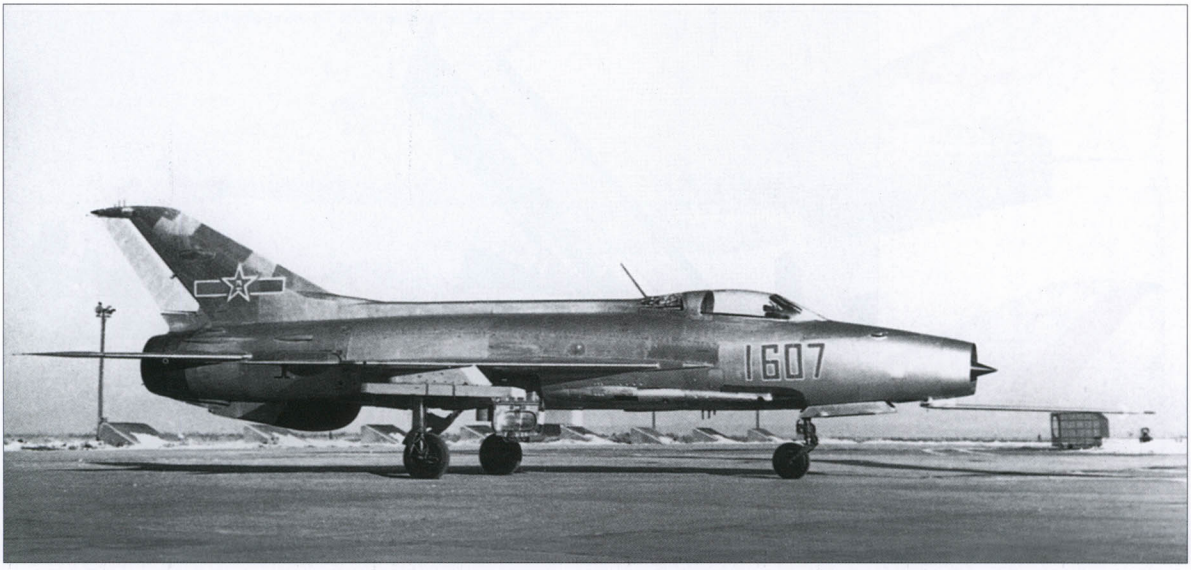
When Soviet technical assistance was cut off after the breakdown in Sino-Soviet relations, it became clear that the commissioning of the Chengdu Aircraft Factory would be delayed. Since the People's Liberation Army Air Force (PLAAF) could not wait to reequip with the new-generation fighter, the Chinese government decided to transfer J-7 production to the aircraft factory in Shenyang (Mukden), Liaoning Province (Manchuria). This plant (now called SAIC – Shenyang Aircraft Industry Corp.), which had a well-established production line, was already manufacturing the MiG-17F and the MiG-19S under licence as the J-5 and the J-6 respectively. At the Shenyang factory the



via Internet

▲
Test pilot Ge Wenrong climbs out of the unserialled J-7 prototype.

'1607 Red', an initial production J-7 with a ventrally located brake parachute and no bulge at the base of the fin.
▼



China Aircraft 1951-1997

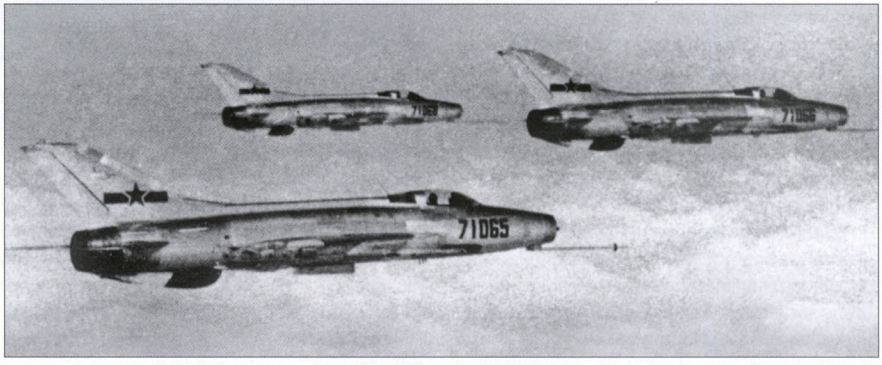
China Aircraft 1951-1997

▲ **'81799 Red', a Chengdu J-7 *sans suffixe* operated by the 9th Division of the People's Liberation Army Naval Air Force (PLANAF), takes off.**

J-7 was allocated the in-house designation 'product 62'.

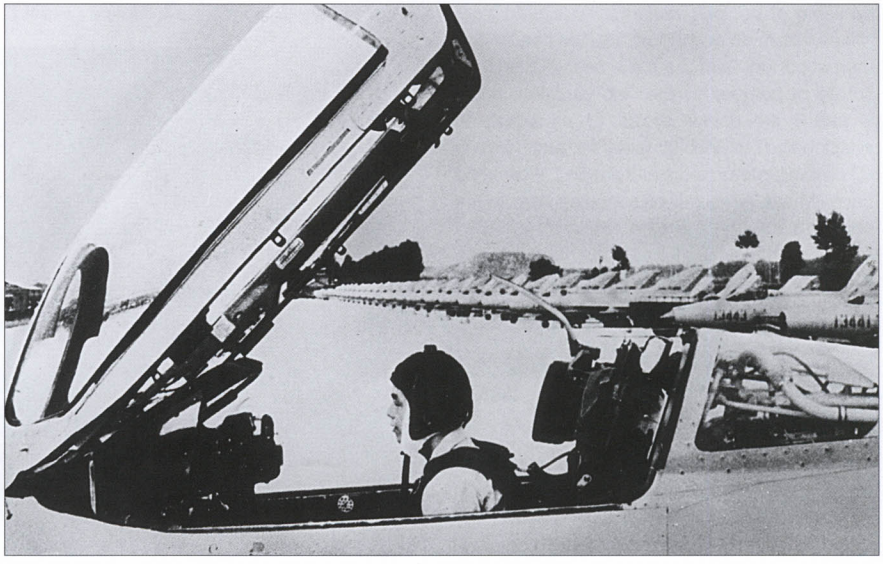
Mastering production of such a complex aircraft proved to be quite a challenge and required a lot of time. A J-7 static test airframe of entirely Chinese manufacture completed its test cycle in November 1965. Two months later, on 17th January 1966, test pilot Ge Wenrong successfully performed the maiden flight of the first Shenyang-built J-7 prototype (apparently bearing no serial). In the course of the flight tests the fighter attained a top speed of Mach 2.02. The second prototype was apparently serialled '0002 Red'.

Yet the type's production career at Shenyang proved to be brief; enter the so-called Cultural Revolution – an ambitious political programme of the Chinese government that backfired, leading to untold chaos and devastation in the national economy and the country's life as a whole. The nationwide political debate quickly turned into fierce confrontation between various clans and repressions against those who refused to follow the party line; the resulting shortage of specialists disorganised the aircraft industry, derailing the PLAAF's reequipment



via Internet

▶ **A flight of Chengdu J-7s operated by the PLAAF's Flight Test & Training Centre (FTTC).**



China Aircraft 1951-1997

▶ **A PLAAF 3rd Division/9th Regiment pilot sits on quick-reaction alert in the cockpit of his J-7 I.**

via Internet

◀ **These J-7s of the PLAAF's 42nd Division are supposedly on QRA duty, but the ground covers over the auxiliary blo-in doors reveal that this is a publicity photo. Note the small bulge at the base of the fin typical of Chengdu-built J-7s *sans suffixe*.**

plans. The Shenyang Aircraft Factory managed to complete only a dozen production J-7s *sans suffixe*. These aircraft were almost identical to the Soviet-built MiG-21F-13; the main differences lay in the temporary lack of missile armament and the fixed air intake centrebody. (The Chinese had not received the part of the manufacturing documents concerned with the

Chris Lofting

▲ **One of the Albanian Air Force's 12 F-7As in front of a hardened aircraft shelter at Rinas AB.**

Another aspect of the same aircraft, showing the J-7 style rear end with no brake parachute fairing below the rudder. ▼

movable centrebody of the Soviet version and used a fixed centrebody as a stopgap measure.)

Chengdu F-7A Export Tactical Fighter

Apart from deliveries to the PLAAF, the initial production version of the J-7 was exported in small numbers, as China felt the need to extend military and political support to its ideological allies – Albania (which was in self-imposed political isolation) and Tanzania. These aircraft were produced by the Chengdu factory. In keeping with Chinese tradition the export fighters received a 'Westernised' designation, F-7A (F for 'fighter'); actually this tradition applies only to fighters and jet trainers, all other Chinese aircraft being exported under their domestic designations.

Chris Lofting

Peter Davison

▲
J-7 I '70162 Red' at the PLAAF Museum in Datang Shan. Note the port cannon and the dorsal brake parachute housing.

'98071 Red', also at Datang Shan, is a modified J-7 *sans suffixe* with the dorsal brake parachute housing but only one cannon.
▼

Contrary to reports in the Western press and the Internet, the F-7A was based on the original J-7 *sans suffixe*, not the later J-7 I (see below). Photos show clearly that, like the PLAAF's Chengdu-built J-7s, the Albanian aircraft lack the port cannon and have a small fairing at the base of the fin but retain the ventral location of the brake parachute in the rear portion of the ventral fin.

Chengdu J-7 (Modified) Tactical Fighter

The J-7 programme was resumed a year later when the Chengdu Aircraft Factory was finally commissioned. The Chinese government now decided to assign the J-7 programme to Chengdu, so that the Shenyang Aircraft Factory could concentrate on the development of the more advanced indigenous J-8 fighter.

Simon To

via Internet

Simon To

▲◄
Here '70162 Red' is seen at an earlier date, mounted on supports at the museum's entrance.

▲
Close-up of the brake parachute housing characteristic of most J-7 versions, showing the upward-hinged hemispherical cover.

via Internet

The first Chengdu-built J-7s rolled off the production line in June 1967. By then the local design office had introduced a number of improvements into the fighter's design. On some J-7s *sans suffixe* this was indicated by a slight bulge at the fin/fuselage junction (closer to the rudder) which was absent on the original MiG-21F; the bulge was faired smoothly into the adjoining structure at both ends, apparently housing some new equipment item(s).

Other examples featured a more obvious change – the brake parachute was relocated from the ventral fin to a cylindrical container at the base of the rudder. This arrangement had been tested successfully before by Mikoyan on the Ye-6V prototype and introduced on production versions from the MiG-21PFS onwards; the Chinese designers were apparently aware of this. However, the J-7's brake parachute container differed from the Soviet design; the MiG-21 had a brake parachute container with a parabolic rear end that was split vertically to form two doors, while the Chinese fighter's container was closed by a one-piece hemispherical fairing hinged at the top. Nevertheless, the fighter retained the one-piece forward-hinged canopy and the single cannon to starboard. Three such aircraft serialled '11244

◄
PLAAF ground crews prepare to arm 3rd Division/ 9th Regiment J-7 Is with PL-2 missiles at Wuhu.

Red' (c/n 714611), '11447 Red' and '98071 Red' are preserved at the PLAAF Museum at Datang Shan.

The modified fighter was built in small numbers, seeing limited service with the PLAAF. When the PL-2 air-to-air missile became available, it was issued to J-7 units.

Chengdu J-7 I Tactical Fighter

The Chengdu Aircraft Factory continued its efforts to improve the J-7. Since the efforts to copy the K-13 IR-homing AAM as the PL-2 were taking longer than anticipated, the Chinese decided to bolster the J-7's armament by reverting to the MiG-21F's original twin-cannon arrangement, reinstating the port Type 30-1 cannon. Also, a variable air intake with a translating shock cone was introduced at last (the Chinese engineers had mastered the design

via Internet

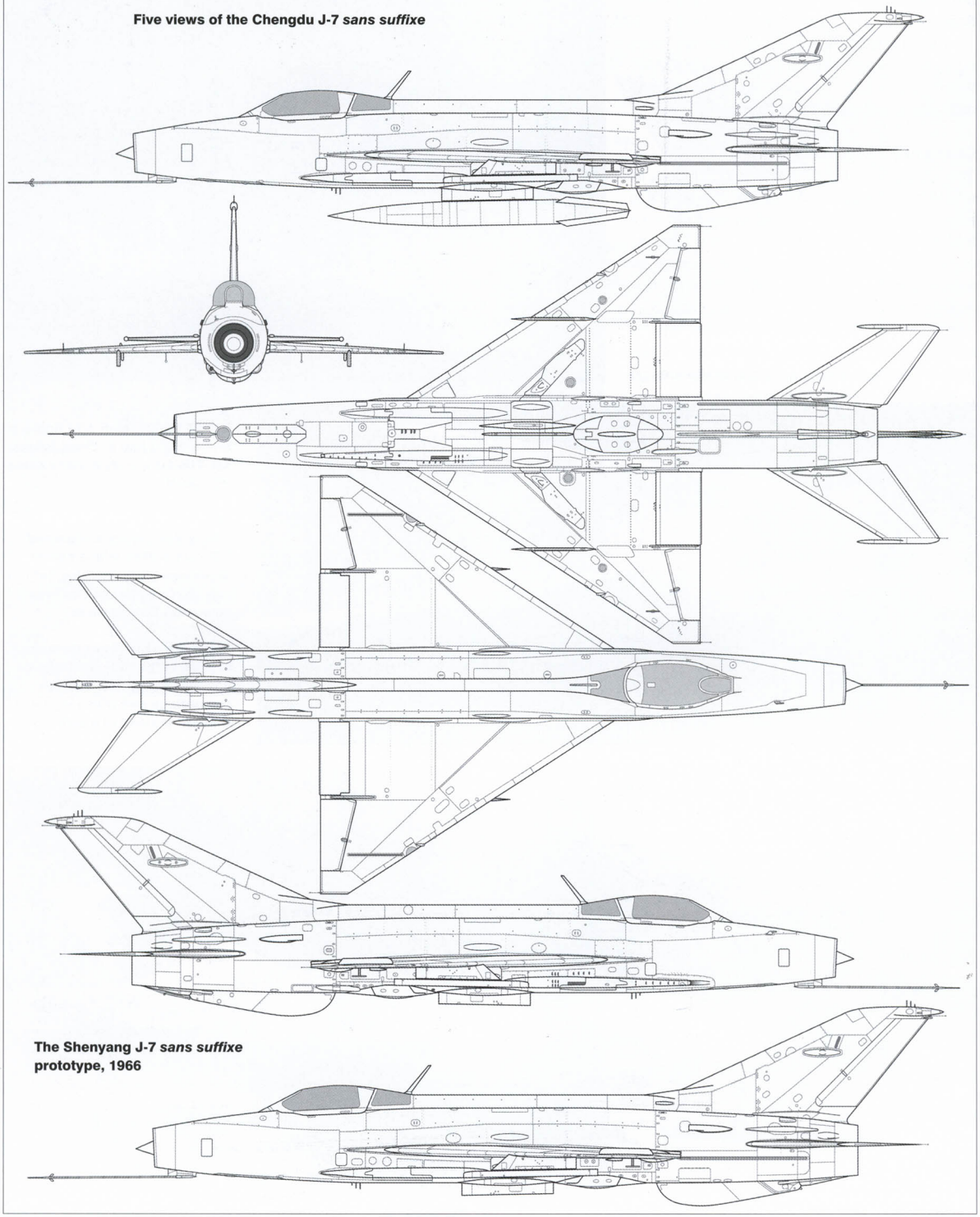
Marcus Fulber

▲
PLAAF 7th Division J-7 I fighters on the flight line at Zhangjiakou AB. The foremost aircraft carries PL-2 AAMs.

◄
'11447 Red', another modified J-7 *sans suffixe* with a dorsal brake parachute housing but one cannon, in desert camouflage colours at Datang Shan.

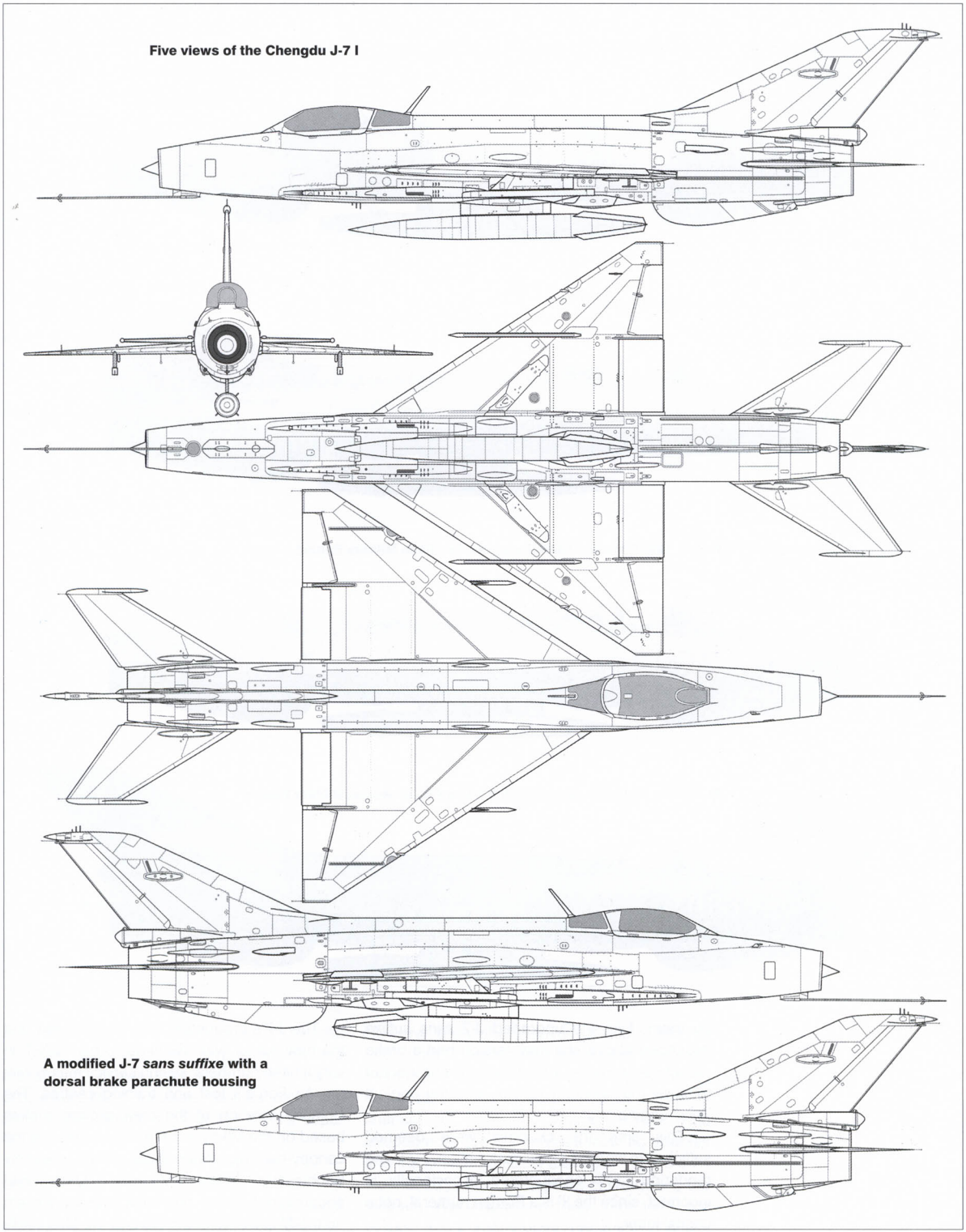
One more example of the same version at the National Defence Park in Beijing, in green/tan camouflage and with a legend in Chinese instead of a serial.
▼

Yefim Gordon archive



Five views of the Chengdu J-7 *sans suffixe*

The Shenyang J-7 *sans suffixe* prototype, 1966



Five views of the Chengdu J-7 I

A modified J-7 *sans suffixe* with a dorsal brake parachute housing

Chengdu J-7 I, PLAAF 7th Division, Zhangjiakou AB, Beijing Military Region
11287
Chengdu J-7 I, PLAAF 9th Division
12284
Chengdu J-7 I, PLAAF 12th Division, Jinan-Jiaoqiang AB, Jinan Military Region
31130
Chengdu J-7 I, PLAAF 1st Flying Academy, Harbin-Lalim AB, Shenyang Military Region
66117

by then). Like the upgraded J-7 *sans suffixe* described above, the new version had a brake parachute container at the base of the rudder but retained the standard canopy and the original WP-7 engine.

This time the changes were deemed sufficient to warrant a new designation, J-7 I. The rendering 'J-7I' encountered occasionally is incorrect, since the 'I' is a Roman numeral, not a capital letter.

The J-7's production rate remained low and the new fighter was delivered to the PLAAF in very limited numbers, seeing service mainly with the Air Force's test and training centres. The Chinese iteration of the crew escape system based on the Mikoyan SK ejection seat and the canopy-cum-slipstream shield proved extremely troublesome. The Mikoyan OKB had encountered similar problems with the system on the MiG-21F/MiG-21F-13 and the MiG-21PF,

A modified J-7 *sans suffixe* with a dorsal brake parachute housing.
National Defence Park, Beijing

A modified J-7 *sans suffixe* with a dorsal brake parachute housing.
PLAAF Museum, Datang Shan

A modified J-7 I with a bulged canopy and a Type 2 ejection seat

A modified J-7 I with a bulged canopy and a Type 2 ejection seat
PLAAF Museum, Datang Shan

but here they were compounded by the problems associated with reverse-engineering the aircraft. Besides, as noted earlier, early-production WP-7 turbojets had an extremely short TBO, severely limiting the J-7 I's capabilities.

The J-7 I's service entry with the PLAAF coincided with the outbreak of the Vietnam War – a conflict in which aircraft were used most extensively in both offensive and defensive roles. However, unlike the Shenyang F-5 (J-5) and F-6 (J-6), both of which were supplied to the North Vietnamese Air Force and actively used in the hostilities, the new supersonic fighter missed its chance to fight in Vietnam. This was undoubtedly due to the type's teething troubles and the limited numbers available. Yet the J-7 I did indeed receive its baptism of fire during the Vietnam War. Between 1969 and 1971 the PLAAF J-7 I interceptors defending China's

Peter Davison

Peter Davison

▲ **J-7 I '9957 Red' was one of several development aircraft with a bulkier canopy necessitated by the installation of the indigenous Type 2 ejection seat. It is seen here preserved at the National Defence Park in Beijing.**

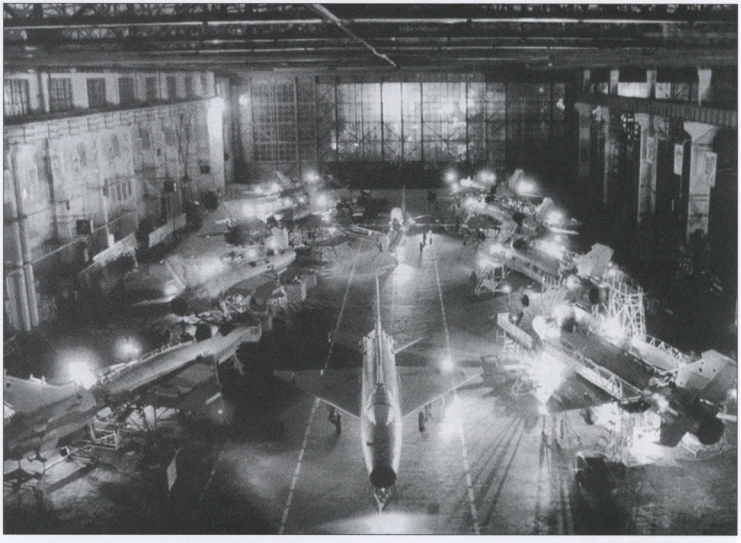
▶ **'3487 Red', another J-7 I refitted with the Type 2 seat and the modified canopy. This aircraft is on display at the PLAAF Museum in Datang Shan.**

Marcus Fulber

Peter Davison

southern borders destroyed six USAF combat aircraft intruding into Chinese airspace, as well as more than 300 drifting balloons that were launched from abroad, laden with reconnaissance equipment and printed matter.

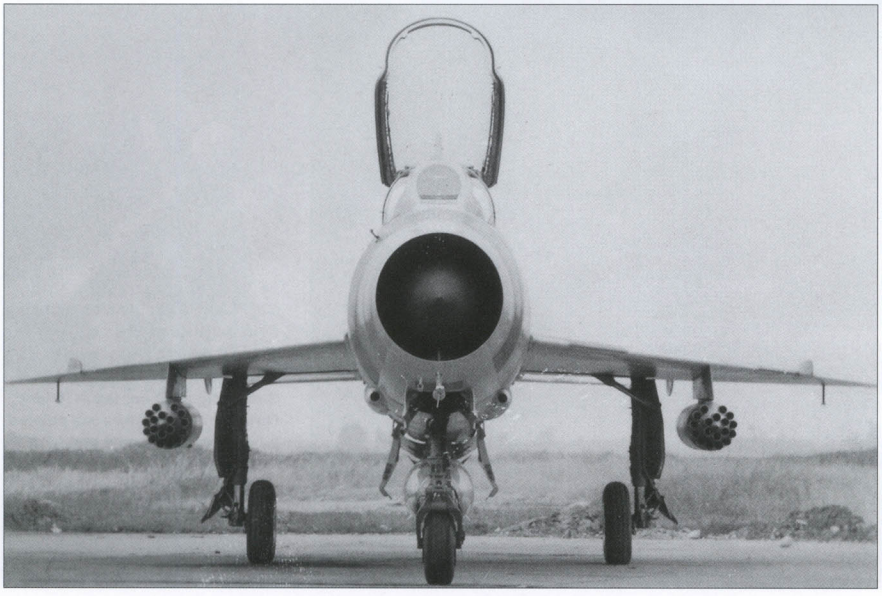
The J-7 I only saw very limited service with the PLAAF and the People's Liberation Army Naval Air Force (PLANAF). This was due to the poor manufacturing quality, design flaws and unsatisfactory performance. Yet, some sources claim that the last remaining examples of the J-7 I were retired from active service as late as the early 1990s!



via Internet

Chengdu J-7 I (Modified) Tactical Fighter

In an attempt to address the problem of the J-7's unsatisfactory crew rescue system the Chengdu Aircraft Factory modified at least two J-7 Is serialled '3487 Red' and '9957 Red'. These were not ejection seat testbeds, of course, being



Yefim Gordon archive

▲▲ **One more view of '3487 Red' at Datang Shan.**

▲ **The final assembly shop at Chengdu, with two freshly completed J-7 II fighters and a further eight nearing completion.**

◀ **A Chengdu J-7 II with two 16-round FFAR pods. The aft-hinged canopy is well visible.**

via Internet

via Internet

▲
Still partly in primer finish but already carrying PL-2 AAMs, a brand-new J-7 II taxies out for a pre-delivery test flight.

◄
'11082 Red', a PLAAF 7th Division J-7 II, streams its brake parachute. Note the locally designed 720-litre drop tank.

►
Wearing orange life vests over their flying outfits, Naval Aviation 8th Division/24th Regiment pilots walk towards their J-7 IIs at Haikou, with ground crew teams waiting beside each fighter.

via Internet

◄
Six PLAAF 33rd Division/98th or 99th Regiment J-7 IIs on QRA duty sit beside the runway at Chongqing-Baishiyi as a Shenyang J-6C comes in to land. Note that the fighters are painted silver overall; usually the J-7 II had an overall white finish.

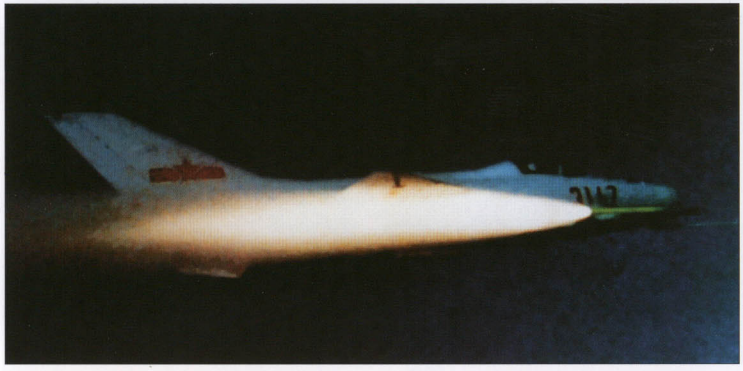
►
PLAAF 44th Division/130th Regiment J-7 IIs lined up at Mengzi.

via Internet

via Internet

via Internet

◄
Another 8th Naval Division/24th Regiment J-7 II deploys its brake parachute on landing. The fin appears to be partially silver-painted.



via Internet

►
More PLANAF J-7 IIs – this time 4th Division/10th Regiment aircraft lined up on parade at Luqiao.

via Internet

single-seaters, but can nevertheless be termed as development aircraft. The SK ejection seat gave place to an indigenous Type 2 cartridge-fired seat permitting safe ejection at lower altitudes within a speed range of 250-850 km/h (155-527 mph); in a later version the minimum safe ejection speed was reduced to 130 km/h (81 mph). The seat had a bulkier headrest that was too large to fit inside the standard cockpit canopy, necessitating a redesign. The new canopy was still hinged at the front but was visibly bulged at the rear, with a taller frame to fit around the seat headrest; the fairing incorporating the small transparency aft of the seat was also revised to mate smoothly with the front portion. Both aircraft had twin cannons.

Yet the PLAAF obviously did not care for the idea of keeping the forward-hinged canopy/slipstream shield, no matter what type of seat was inside. Hence the designers at Chengdu had to develop a new canopy offering higher safety during ejection (see next entry). The two aircraft mentioned above became museum exhibits; silver-painted '9957 Red' is preserved at the National Defence Park, while '3487 Red' wearing a three-tone blue camouflage is on display at the PLAAF Museum at Datang Shan AB.

Chengdu J-7 II Tactical Fighter

In 1974 the Chengdu Aircraft Factory began development of a further refined version designated J-7 II. Its most obvious external identification feature was the new cockpit canopy optimised for the Type 2 ejection seat that had been tested on the interim version

▲◄
'3147 Red', a J-7 IIH (alias J-7H), fires a PL-5 AAM. Judging by the four-digit serial, this is one of the prototypes.

◄
A 30th Division/55th Regiment J-7 II ('30905 Red'?) is towed by a jeep.

►
PLAAF 9th Division/25th Regiment J-7 IIs at Fo Shan AB. The pilots marching along in very orderly double file with the helmets still on add a somewhat artificial touch to the scene.

via Internet

China Aircraft 1951-1997

via Internet

▶ **J-7 IIH '3147 Red' retracts the landing gear on take-off. Note the extra pair of wing pylons. PL-5 AAMs are carried on the inboard pylons.**

Routine maintenance of '14138 Red', a J-7 II operated by the PLAAF 2nd Division/4th Regiment at Suixi. The fighter carries a drop tank and two AAMs. ▼

Still in chrome yellow primer finish, a J-7 II is seen shortly after rollout at Chengdu. ▼▼

via Internet

F-7 II '950137 Red' in tactical camouflage colours is a development aircraft operated by the manufacturer, as indicated by the non-standard six-digit serial. It was used for testing stealth technology in the form of radiation-absorbing material (RAM) coatings. ▼

described above. The strongly convex canopy consisted of a fixed windshield (featuring a birdproof windscreen and two sidelights) and a hinged rear portion. Thus, the J-7's canopy development mirrored that of its Soviet progenitor. Unlike the MiG-21, the rear canopy portion was hinged at the rear, not to starboard, and the structure aft of it tapered off quickly into the same shallow spine as before.

Over 300 test ejections both on the ground and in the air demonstrated the new seat's higher capabilities. It may as well be said now that the Type 2 ejection seat was first used operationally (that is, in a real-life emergency) in 1984. A year later the designers of the seat were awarded the National Gold Quality Medal in recognition of their work.

Not so obvious was the fact that the J-7 II was powered by an improved WP-7B turbojet; this engine had a 12.8% higher dry thrust, a 70% higher afterburning thrust – 6,100 kgp (13,450

via Internet

via Internet

lbst) versus 5,100 kgp (11,240 lbst) – and a TBO doubled to 200 hours. Surprisingly perhaps, the J-7 II reverted to the fixed-geometry air intake – apparently the Chinese version of the variable air intake tried on the previous version proved unsatisfactory. A longer and fatter drop tank with a more rounded nose holding 720 litres (158.4 Imp gal) was developed for the J-7 II, replacing the original 480-litre (105.6 Imp gal) model to give longer range. Changes were made to the equipment and armament; in particular, the PL-2 AAM became a standard fit at last. Also, the brake parachute container was modified, allowing the parachute to be deployed at higher speed; the aircraft was able to deploy the parachute less than 1 m (3 ft) above the ground, reducing the landing run to less than 800 m (2,640 ft).

The J-7 II prototype performed its maiden flight on 30th December 1978 with test pilot Yu Mingwen at the controls. Production commenced soon afterwards, and the J-7 II entered PLAAF service in the early 1980s. This was the first member of the J-7 family to be produced in significant numbers. Yet the production rate remained low; for instance, in 1989 the Chengdu Aircraft Factory delivered a mere 14 examples. Even though the PLAAF and the PLANAF were in

via Internet

via Internet

China Aircraft 1951-1997

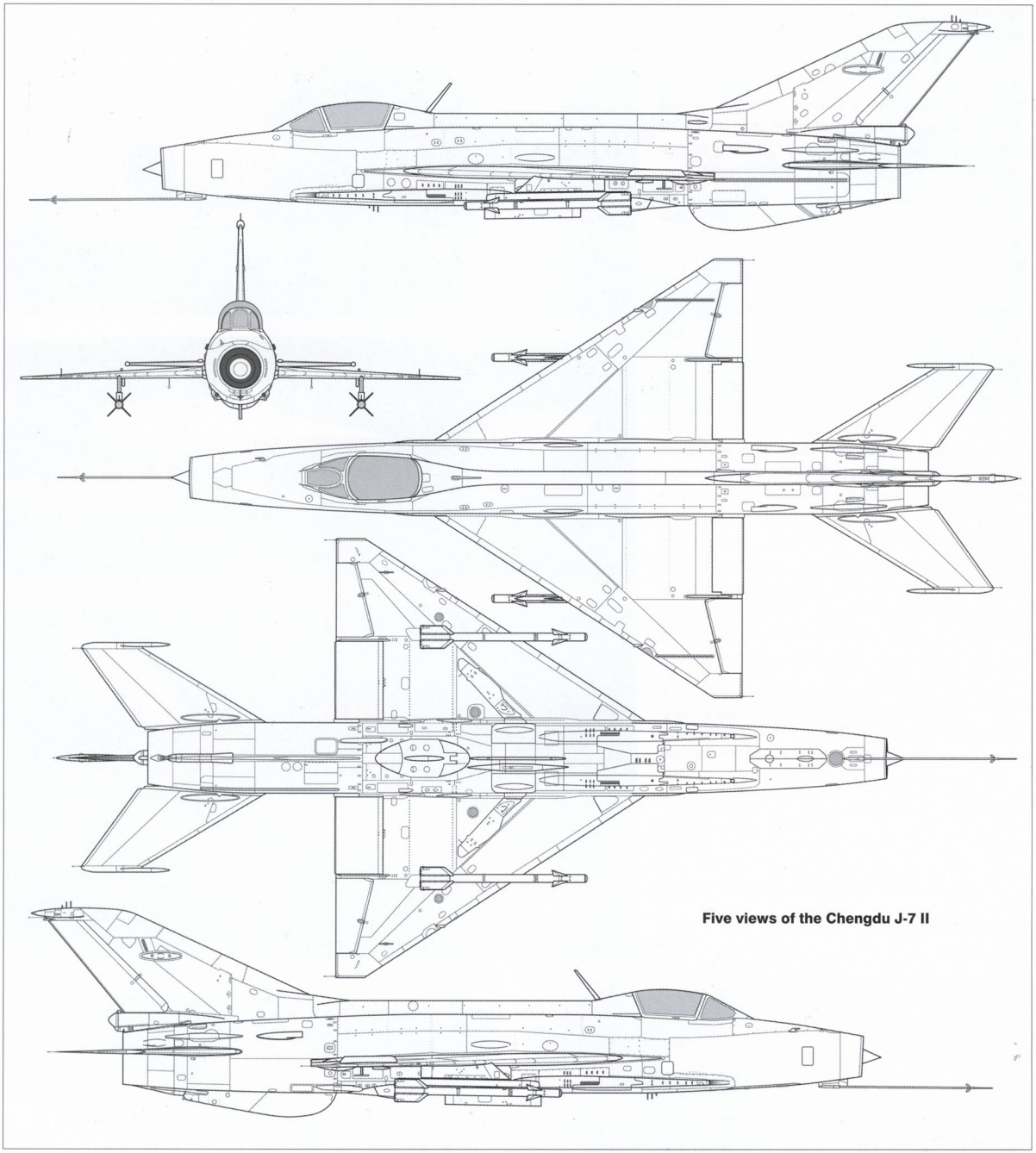
via Internet

►▲▲
Some of the development aircraft owned by the Chengdu Aircraft Corp. had unusual serials prefixed CAC. This is CAC 0134 – probably the first prototype of the F-7 II (the J-7 II's export version).

►▲
CAC 0138, another F-7 II prototype, in the original demonstrator livery.

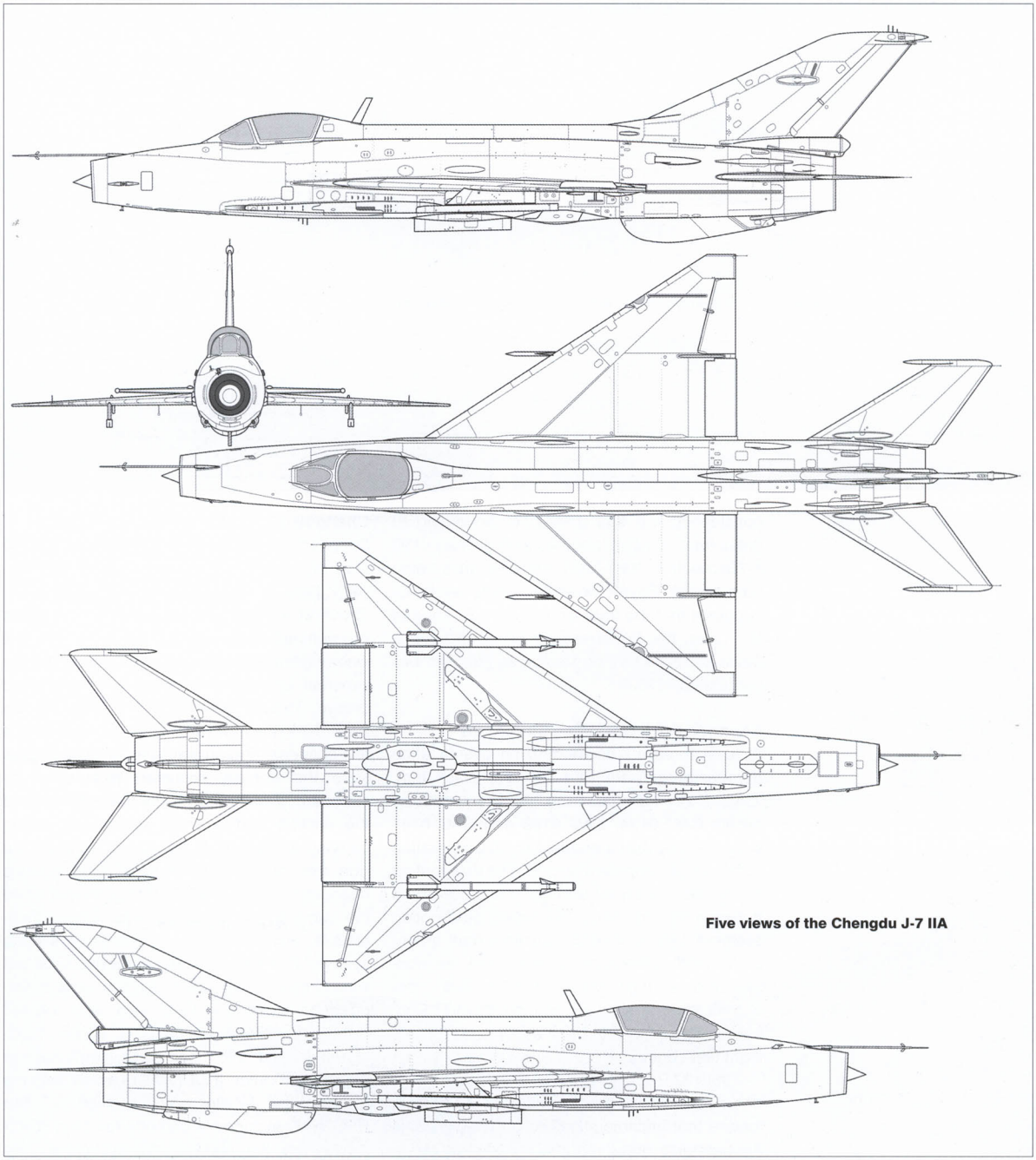
►
One more F-7 II demonstrator, CAC 0141.

Former CAC 0138 in later guise as '950138 Red'.
▼



Five views of the Chengdu J-7 II

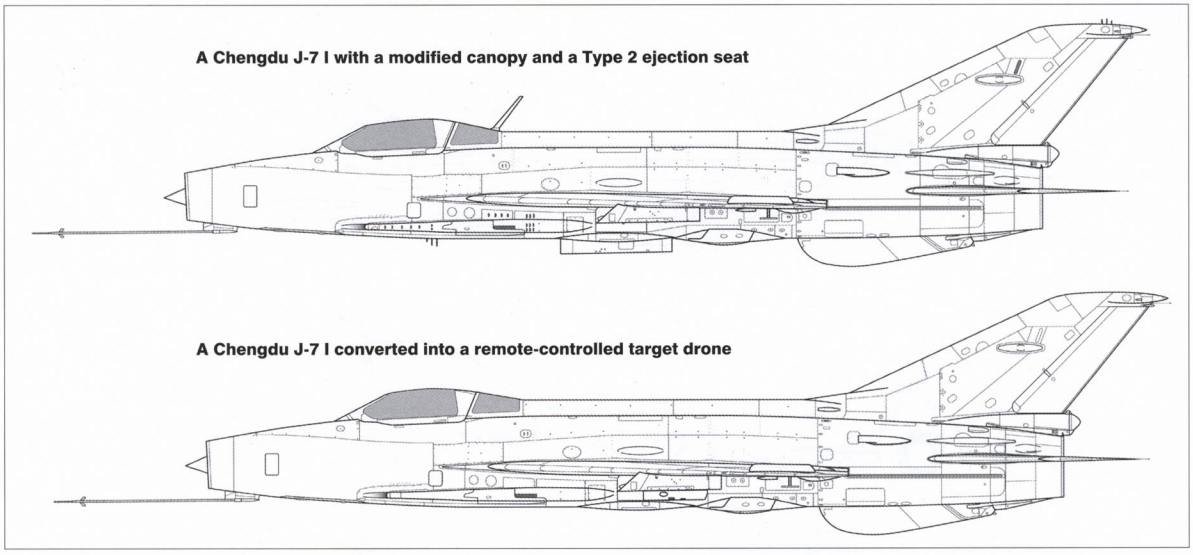
urgent need of a modern fighter aircraft to replace the ageing J-5s and J-6s, which had been in service since the 1950s, foreign customers seemed to enjoy priority and China was aggressively promoting the J-7 II on the export market. Apparently the Chinese defence industry was so eager to earn much-needed hard currency for a technology upgrade that it was prepared to give foreign customers first-delivery positions, to the detriment of the nation's own armed forces.



Five views of the Chengdu J-7 IIA

Chengdu F-7B Export Tactical Fighter

Work on the export version of the J-7 II, known as the F-7B, started in 1979. The fighter's two wing pylons were re-wired to permit carriage of the French Matra R.550 Magic IR-homing short-range AAM, which was also reverse-engineered and built in China as the PL-7 for export. The Egyptian Air Force was the launch customer; according to Egyptian pilots, the F-7B had generally higher performance than the original Soviet-built MiG-21F-13s delivered to the EAF in the mid-1960s – which was unsurprising,



A Chengdu J-7 I with a modified canopy and a Type 2 ejection seat

A Chengdu J-7 I converted into a remote-controlled target drone

considering the age difference. According to press reports, Egypt and Iraq took delivery of 90 F-7Bs each in 1982-1983, the Iraqi units being paid for by Egypt; however, photo evidence suggests that the Iraqi aircraft were F-7Ms, not Bs. Later, the Sudanese Air Force ordered a batch of 15 F-7Bs; the Sudanese contract was completed in 1996.

Chengdu F-7 II Development Aircraft

At least three J-7 IIs wearing an overall white demonstrator livery with red and black trim, 'CAC F-7II' tail titles and the demonstrator serials CAC 0134, CAC 0138 and CAC 0141 were used by the Chengdu Aircraft Corporation (CAC) as development aircraft. The designation F-7 II was somewhat unusual – a cross-breed between the domestic and export designation systems. Later CAC 0138 gained a dark green/dark earth camouflage scheme and the non-standard six-digit serial '950138 Red'; this aircraft and the similarly painted '950137 Red' were apparently operated by one of China's flight test centres.

'950137 Red' was unusual in having the pitot boom relocated to the upper side of the nose, a feature that became standard on late versions. According to press reports, this aircraft was a stealth technology testbed; since the airframe of the basic MiG-21F/J-7 II is anything but 'stealthy', it may be surmised that '950137 Red' was used for testing radar-absorbing material (RAM) coatings. The other machine retained the normal undernose pitot installation.

Chengdu J-7 IIA (F-7 IIA) Tactical Fighter

Despite the improvements made on the J-7 II, the type no longer met the demands of the day, particularly in the eyes of foreign customers. Therefore in 1984 CAC announced an upgrade programme; designated J-7 IIA (or F-7 IIA), this was an attempt to bring the type up to date at the expense of minimum changes to the basic design. Though outwardly very similar to the basic J-7 II, the new variant incorporated quite a few changes. The outward recognition features were the dorsally mounted pitot offset to starboard, a wider-than-usual blade aerial aft of the cockpit and a small streamlined fairing carrying a pitch (AoA) transducer vane on the port side of the extreme nose. Less obvious changes included a WP-7BM engine, which had the same thrust rating but was lighter, more reliable and featured an improved starting system. The cockpit had a stronger birdproof windscreen, a zero-zero ejection seat developed in-house by CAC and an updated instrument layout featuring a British GEC-Marconi Type 956 head-up display/weapons aiming computer (HUD/WAC), which became standard for J-7 fighters from then on. The HUD/WAC included a cathode-ray tube (CRT) display on the main instrument panel. The landing gear was reinforced as well.

The avionics suite now included a GEC-Marconi Type 226 Skyranger target ranging radar with electronic counter-countermeasures (ECCM) capability, an air data computer, new radios, navigation aids, and IFF transponder. The presence of new radios was revealed by

via Internet

▲
'71169 Red', a J-7 IIA operated by the FTTC. Note the wide blade aerial and the AoA sensor fairing on the port side of the nose.

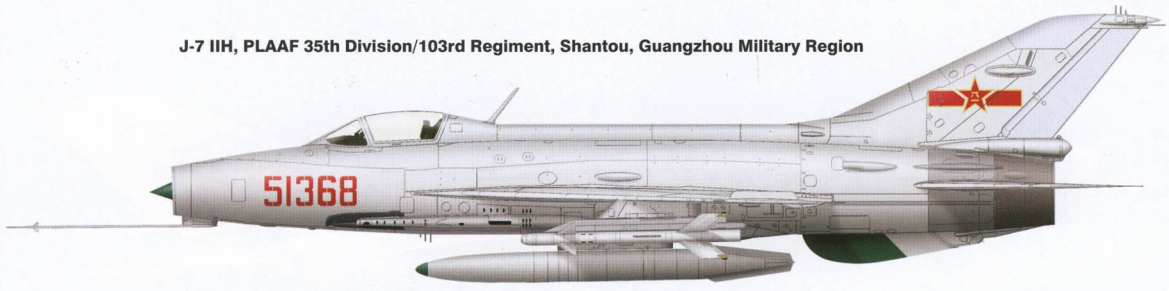
via Internet

▶
Former F-7 II CAC 0141 after modification and repainting as the F-7 IIA demonstrator (see also page 278).

This view of CAC 0141 shows the F-7IIA titles and the offset dorsally mounted pitot.
▼

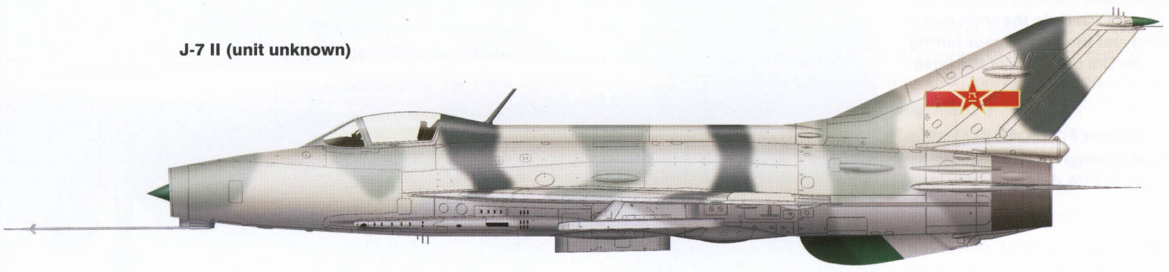
via Internet

J-7 IIH, PLAAF 35th Division/103rd Regiment, Shantou, Guangzhou Military Region

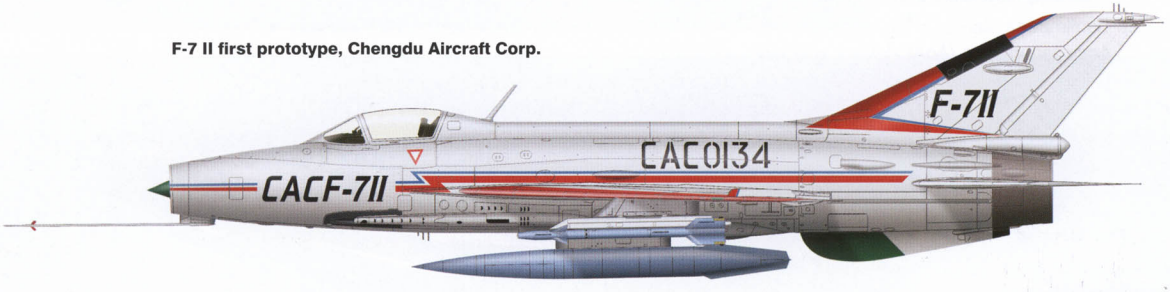


J-7 IIH, PLAAF 14th Division/41st Regiment, Nanchang, Nanjing Military Region

J-7 II (unit unknown)



F-7 II first prototype, Chengdu Aircraft Corp.



F-7 II second prototype (formerly CAC 0138)

aforementioned broad-chord blade aerial. The J-7 IIA was armed with twin Type 30-1 cannons with 60 rpg and could carry the Chinese PL-2 AAM or the Matra Magic.

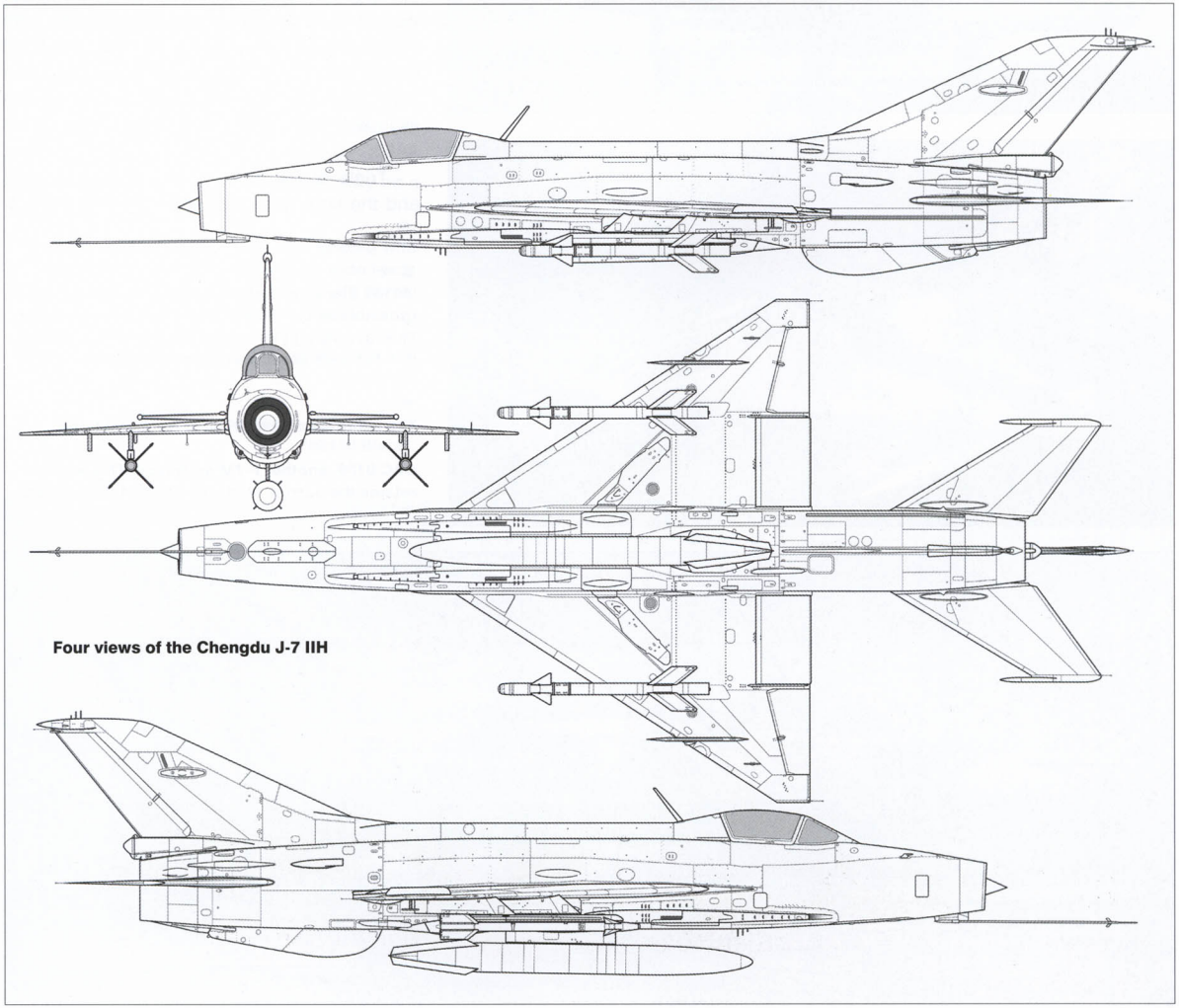
The improved J-7 IIA first flew on 7th March 1984. The prototype, which was converted from F-7 II CAC 0141, wore two-tone grey camouflage with the serial below the cockpit and 'F-7IIA' tail titles. Later it was converted again as one of the F-7M prototypes and repainted in a brown camouflage scheme.

Chengdu F-7BS Tactical Fighter

Soon CAC began developing sub-variants tailored to the requirements of specific customers, with appropriately revised designations. One of these was the F-7BS brought out in 1991 for the Sri Lankan Air Force (hence the S for Sri Lanka); four aircraft were delivered. This fighter retained the less sophisticated Chinese avionics, lacking the HUD/WAC. The F-7BS can best be described as a cross-breed between the F-7B and the F-7M, with four wing pylons instead of the traditional two'. Surprisingly, however, until recently the four Sri Lankan F-7BSs were invariably seen with only two wing pylons.

Chengdu F-7M Airguard Tactical Fighter

The F-7M export version, which was marketed under the name Airguard, represented a major step towards improving the F-7's capabilities and export potential. This version was based on the F-7 IIA, incorporating all of the improvements listed under that heading and more. In May 1979 China signed an agreement with GEC-Marconi, which would supply the avionics suite –



Four views of the Chengdu J-7 IIH

via Internet

◄
CF705, a Chengdu F-7BS delivered to the Sri Lankan Air Force. The Sri Lankan version had two wing hardpoints.

the HUD/WAC package, the Skyranger target ranging radar, the digital mainframe computer, the radio altimeter, the communications suite and the IFF transponder. The new avionics necessitated changes to the electric system – specifically, the installation of a more powerful generator.

In addition to the new avionics, the WP-7BM engine, the reinforced windshield and landing gear, and the relocated pitot, the F-7M had an important feature that the F-7 IIA lacked. The wing structure was revised to allow installation of two additional pylons outboard of the existing ones (at the ailerons' mid-span); these pylons were 'wet', enabling the carriage of two 480-litre (105.6 Imp gal) drop tanks. All in all, the F-7M incorporated seven foreign avionics items and eight domestic improvements. The armament included PL-2 and Matra R550 Magic/PL-7 AAMs.

Trials of the F-7M began in August 1983 and the type was certified in November 1984.

via Internet

▲◄
'84134 Black', one of the prototypes of the F-7M (possibly ex F-7 II CAC 0134), in its original guise. The four wing pylons (note the three drop tanks) and the wide blade aerial are well visible.

via Internet

◄
The same aircraft with 'F-7M Airguard' titles.

CAC 0139, another F-7M prototype. This aircraft retains the narrow blade aerial aft of the cockpit.
▼

China Aircraft 1951-1997

via Internet

The development programme involved a whole host of prototypes, including '84134 Black', '86140 Black', '89140 Black', '950140 Red', CAC 0139 and CAC 0141 wearing a variety of camouflage patterns. (Possibly '86140 Black', '89140 Black' and '950140 Red' were different identities of the same aircraft at various stages of its test career, while '84134 Black' may be a

via Internet

F-7M '86140 Black' (seen here after landing with AAMs and FFAR pods) again had a wide blade aerial.

Front view of the same aircraft, showing the two cannons.

Possibly the same machine in later guise as '89140 Black'.

via Internet

▶
'950140 Red' operated by CFTE may be yet another guise of the F-7M shown on page 277.

CAC 0141 as originally flown after conversion to an F-7M.
▼

The same aircraft with titles applied. In the centre picture CAC 0141 appears to be equipped for target towing.
▼▼

via Internet

via Internet

via Internet

China Aircraft 1951-1997

conversion of F-7 II CAC 0134, but this is *not* confirmed.)

Export sales commenced in 1985 and the F-7M remained in production until the late 1990s. It was supplied to Bangladesh (see F-7MB), Iran (which received 18 units) and Myanmar (24 units). Many sources quote Zimbabwe as an operator of the F-7M, but this is not the case (see F-7 IIN below).

Chengdu F-7M Avionics Testbed

Until the early 2000s, at least one F-7M (identity unknown) was reportedly used by the Chinese Flight Test Establishment (CFTE) as a radar and avionics testbed. The avionics fit changed in the course of the different test programmes.

Chengdu F-7MB Tactical Fighter

The 16 F-7Ms delivered to the Bangladesh Air Force were built in a customised configuration designated F-7MB (the B denoting Bangladesh), with capability to carry reconnaissance pods.

Chengdu J-7 IIM Tactical Fighter

This designation applied to PLAAF J-7 IIs upgraded to F-7M standard.

Chengdu J-7 IIH Tactical Fighter

The J-7 IIH was a J-7 IIA derivative with enhanced ground attack capability (hence the H for *hongzhaji* – strike aircraft). This was the first version to have versatile weapons adapters/missile rails compatible with all types ordnance carried by the aircraft. The use of a single type of weapons adapter instead of many different ones greatly reduced the time and resources needed during day-to-day operation.

Chengdu F-7P Skybolt Tactical Fighter

In early 1987 China's strategic ally, Pakistan, began sizing up the F-7M. Two examples were delivered to the Pakistani Air Force (PAF) for evaluation, which took place at Peshawar and Masroor airbases; this included assessment of

via Internet

▲ Two F-7MBs of the Bangladesh Air Force's No. 5 Sqn 'Thundercats' demonstrate their ability to carry underwing drop tanks.

via Internet

▶ '51368 Red', a J-7 IIH operated by the PLAAF 35th Division/103rd Regiment.

via Internet

▶ A pair of PLAAF 14th Division J-7 IIHs takes off, carrying PL-8 AAMs under the wings.

both air-to-air and air-to-ground performance. After the evaluation, the PAF requested that a number of changes be made to the fighter's equipment and armament; these included installation of a British Martin-Baker Mk 10L zero-zero ejection seat and the ability to carry four US-built AIM-9P Sidewinder AAMs. The avionics included a GEC Marconi Type 226 Skyranger 7M radar. The resulting version was designated F-7P, the P indicating that the design was tailored to Pakistani requirements; the marketing name Skybolt was assigned initially but this proved shortlived.

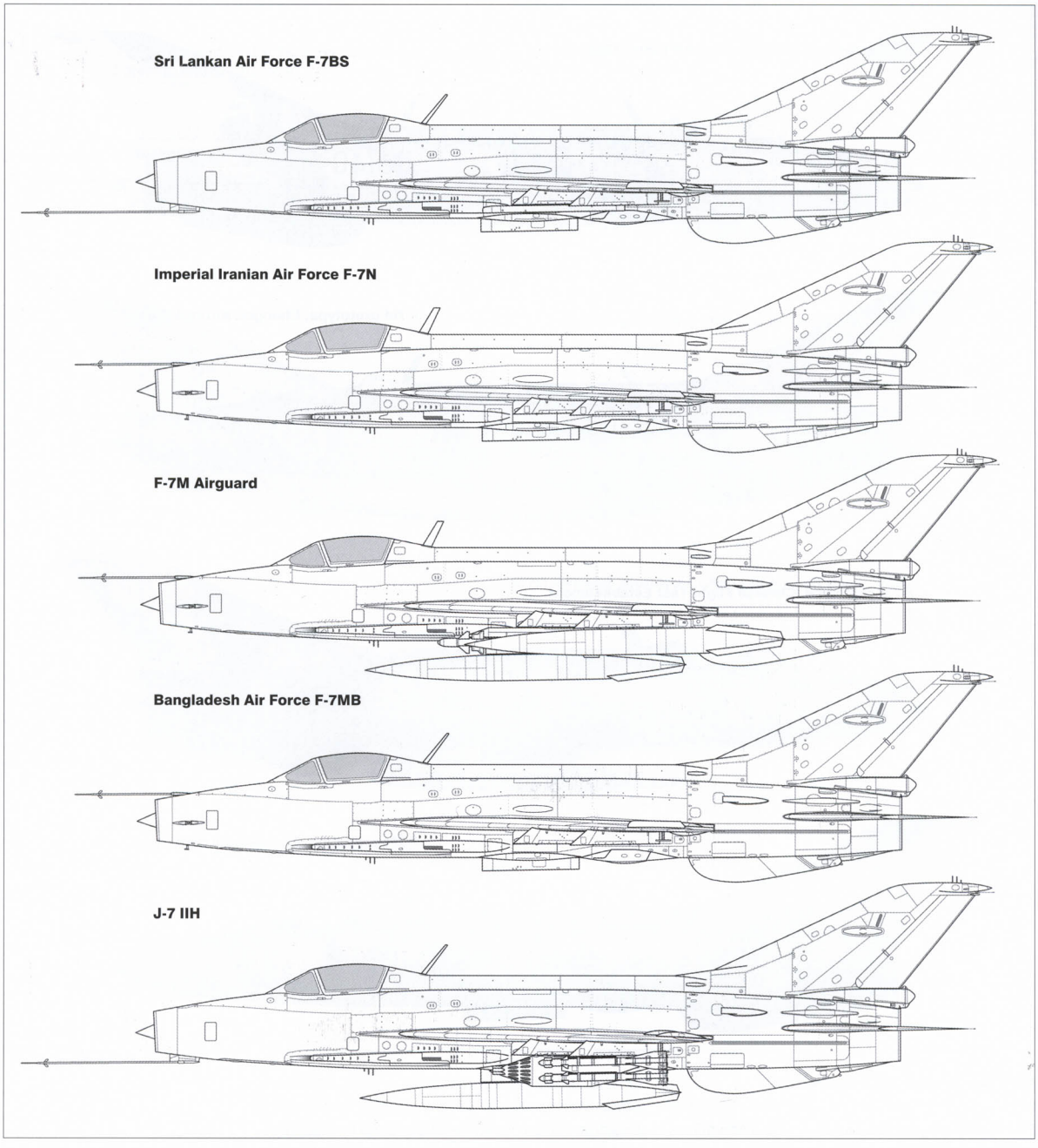
The PAF placed an initial order for 20 F-7Ps and these were delivered to No. 20 Squadron in November 1988. A second batch of sixty F-7Ps followed in 1988-89 and another forty in 1993. All F-7Ps were ferried to Pakistan by PAF pilots. The 120 aircraft delivered saw service with six first-line squadrons and also a squadron of the Combat Commanders School.

Chengdu F-7MP Tactical Fighter

Soon the PAF became dissatisfied with the F-7P's Skyranger radar that imposed limitations on the fighter's capabilities. Hence the PAF announced a tender, issuing requests for proposals to South Africa and Italy for developing a compact, capable and cost-effective replacement radar for the F-7. The choice fell on the Grifo-7 fire control radar developed by the Italian company FIAR (now Galileo), as its offer was very economical and sound.

The Italian radar featuring a slot antenna planar array weighed 55 kg (121.2 lb) and had a detection range in excess of 50 km (31 miles). In contrast, the British radar with a parabolic antenna weighed only 42 kg (92 lb) but had a range of only 15 km (9.3 miles). Both radars had a mean time between failure (MTBF) rate of 200 hours.

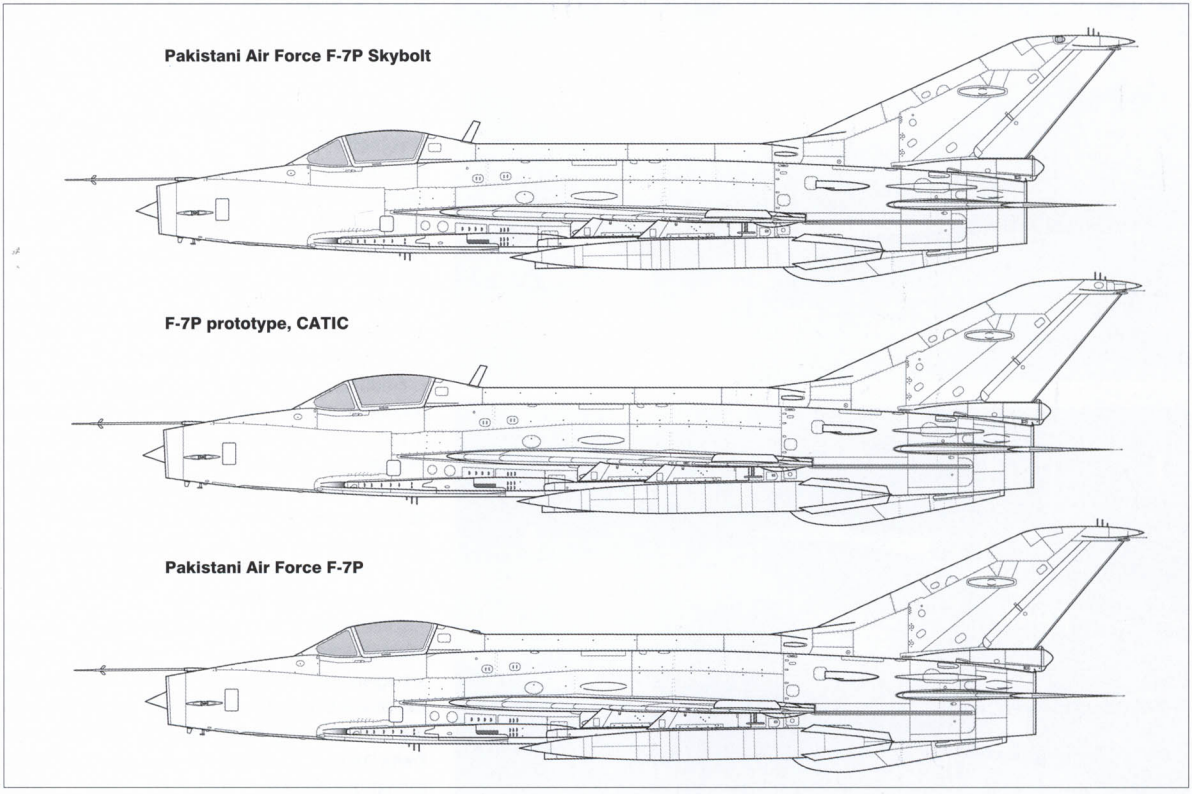
A contract to co-produce 100 Grifo-7 radars was signed in June 1993, pursuant to which the radars were to be assembled by the ISO-9002



certified Kamra Avionics and Radar Factory (KARF), a division of the Pakistan Aeronautical Complex (PAC).

Additionally, the fighter had US-supplied Rockwell Collins avionics – the AN/ARN-147 VOR/ILS receiver, the AN/ARN-149 ADF and the Pro Line II digital DME set. The cockpit layout was revised accordingly. All in all, the aircraft incorporated 24 changes (although some sources claim there were nearly 100 changes!).

The upgraded aircraft was known as the F-7MP ('modified P'); the designation F-7PM is also quoted occasionally. Flight tests began in May 1996 and were completed in 1997.



▶ **The F-7P Skybolt prototype combined Pakistani Air Force insignia with China Aviation Technology Industrial Corp. (CATIC) titles and logo. Note the Sidewinder AAMs on the inboard pylons.**

China Aircraft 1951-1997

via Internet

via RART

▲ **An artist's impression and a model of the second projected fighter to be designated Super 7. At this stage only the tail unit bore a resemblance to the J-7. The 'second-generation' Super 7 was a stepping stone from the J-7CP to the Chengdu FC-1 (aka JF-17), which is totally unrelated to the MiG-21.**

Some sources say the F-7MP was eventually upgraded with the improved FIAR Grifo Mk II radar. In comparison to the Grifo 7, the new radar only weighed an extra 1 kg (2.2 lb) – that is, 56 kg (123.4 lb), but the sector of scan was increased from the original ±10° to ±20°. The newer radar also had improved ECM and look-down/shoot-down capability and could track four targets simultaneously while engaging one of them.

Chengdu J-7 IIK Tactical Fighter (Project)

Proceeding from experienced gained with the F-7MP, CAC had plans to upgrade the PLAAF's J-7 IIs to F-7MP/F-7P standard. The resulting configuration was designated J-7 IIK. It is not known if the upgrade was ever implemented.

Chengdu J-7CP Super 7 Tactical Fighter (Project)

Inspired by the successful sale of the GEC-Marconi Skyranger 7M radar to China for the F-7, in the mid-1980s the British aircraft industry proposed a massive upgrade of the F-7M to improve its performance. Provisionally designated Super 7, the fighter was to be reengined with a modern afterburning turbofan – either the General Electric F404-GE-400 rated at 4,990 kgp (11,000 lbst) dry and 7,260 kgp (16,000 lbst) reheat or the Pratt & Whitney PW1120 rated at 6,150 kgp (13,550 lbst) dry and 9,350 kgp (20,620 lbst) reheat – and fitted with a new fire control radar. The radar options included the British Ferranti Red Fox (a repackaged version of Blue Fox radar used on the British Aerospace Sea Harrier FRS.1 naval fighter) and the US-made Emerson AN/APG-69.

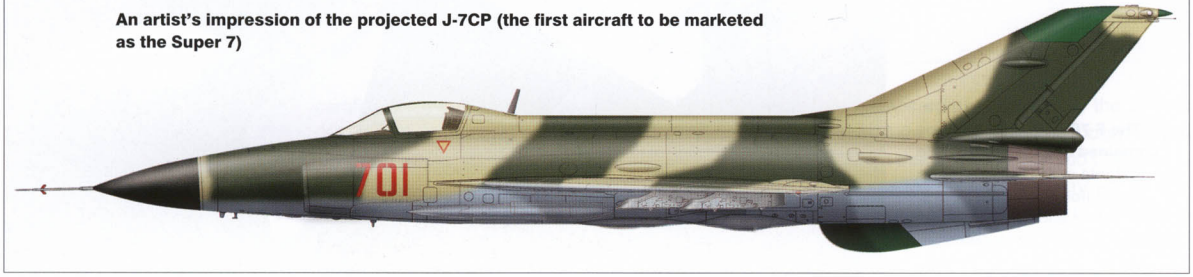
The new radar was too bulky to fit inside a nose air intake. Therefore the latter gave place to an ogival radome and two small intakes flanking the forward fuselage in line with the windshield; the result looked rather like the Convair F-102 Delta Dagger. The rest of the airframe was similar to that of the F-7 II.

Although the radar tests were successful, the upgrade was rejected before engine tests could begin. The idea was not viable economically – the radar and the engine each cost more than a new J-7 (the latter had a price tag of US$ 2 million in 1984 prices). The name 'Super 7', however, was later reused for a rather different project, which was for all intents and purposes a separate design. This did not materialise either but served as a stepping stone toward the Chengdu FC-1 fighter (aka JF-17 Thunder).

Chengdu J-7 III (J-7C) Tactical Fighter

In parallel with the development of the F-7M Airguard, in 1981 the Chengdu Aircraft Corp.

An artist's impression of the projected J-7CP (the first aircraft to be marketed as the Super 7)

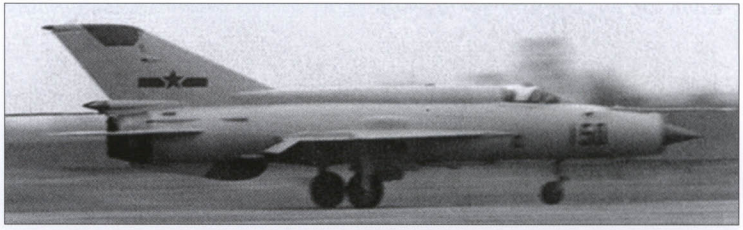


joined forces with the Guizhou Aircraft Industry Corp., another manufacturer of the J-7/F-7 family, to create a true all-weather version of the fighter. The project was initially proposed in 1972 but did not enter full-scale development until the late 1970s. The aircraft received the designation J-7 III (later renamed J-7C).

This was essentially an attempt to reverse-engineer the MiG-21MF. No MiG-21MFs were delivered to the PLAAF by the Soviet Union; however, China succeeded in obtaining via secret channels at least one example of *izdeliye* 96F from Egypt, which was on friendly terms with both nations, in February 1979. Painted light grey overall and serialled '150 Red', this machine underwent extensive testing in China; it served as the pattern aircraft for the J-7 III.

The development and production responsbilities were shared between CAC, which was responsible for the fighter's fuselage and final assembly, and GAIC, which would supply the wings and landing gear.

Outwardly the J-7 III was almost identical to the MiG-21MF, featuring the same large-diameter air intake with a large conical dielectric centrebody, the two-piece cockpit canopy opening to starboard, the fat fuselage spine housing a fuel tank, the broad-chord fin and the ventral cannon installation. The wings featured blown flaps. The most obvious external



via Internet

via Internet

via Internet

▲▲▲
'150 Red', a genuine MiG-21MF obtained from Egypt and tested by the Chinese. The pointed end of the brake parachute housing is the giveaway.

▲▲
'151 Red' was the first prototype of the J-7 III (aka J-7C), as revealed by the hemispherical brake parachute container cap and the typically Chinese 720-litre drop tank. Here the machine is in the original overall grey air superiority finish and carries four PL-5 AAMs.

▲
The same aircraft at a later date in demonstrator colours.

◄
Here, J-7 III '151 Red' is shown with underwing drop tanks and various weapons options, including 55- and 90-mm FFARs, 100- and 250-kg bombs, and PL-5 AAMs.

www.SinoDefence.com

www.Pic.Top81.cn

▲ **J-7 III '950151 Red' (ex '151 Red') in demo colours takes off with three drop tanks.**

▶ **Production J-7Cs in two-tone camouflage colours operated by the PLAAF 15th Division.**

▼ **A line-up of J-7Cs of an unidentified unit with PL-5 AAMs and centreline drop tanks.**

▶▼

via Internet

difference was the brake parachute container, which was closed by a J-7 I/II style upward-opening hemispherical cover instead of the MiG-21MF's vertically split doors.

The J-7 III was powered by a WP-13 afterburning turbojet equivalent, but apparently not identical, to the Tumanskiy R13-300; the engine was rated at 4,100 kgp (9,040 lbst) dry and 6,600 kg (14,550 lbst) reheat. The WP-13 was reported as an indigenous product jointly developed by the Guizhou Engine Company and the Chengdu Engine Company. Development began in 1978, ten prototype engines having been manufactured by 1984, and certification was achieved in 1985. As compared to the WP-7, the new engine had substantially higher surge resistance, higher reliability and a longer service life.

The crew escape system was based on a new HTY-4 zero-zero ejection seat built by CAC. The canopy featured a rear-vision periscope making up for the deterioration in rearward view caused by the different canopy/spine design.

The intake centrebody housed a new radar whose development proceeded in parallel with the reverse-engineering effort. Several models were tried, including the Type 317 and Type 317A radars which passed a complete test cycle on ground rigs and flying testbeds. The JL-7 pulse-Doppler fire control radar was selected eventually; based on integrated circuit technology, it could operate both in air-to-air (search/track/IFF) and air-to-ground (rangefinding) modes. The radar weighed 100 kg (220 lb);

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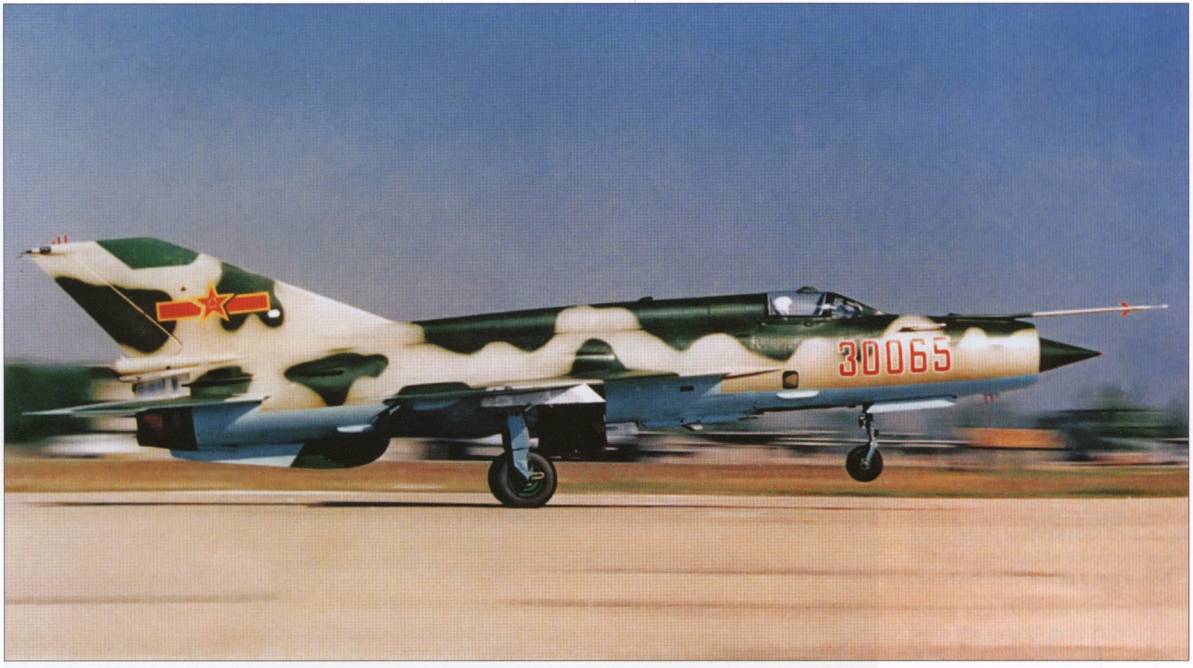

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maximum detection range was 28 km (17 miles) and MTBF was 70 hours.

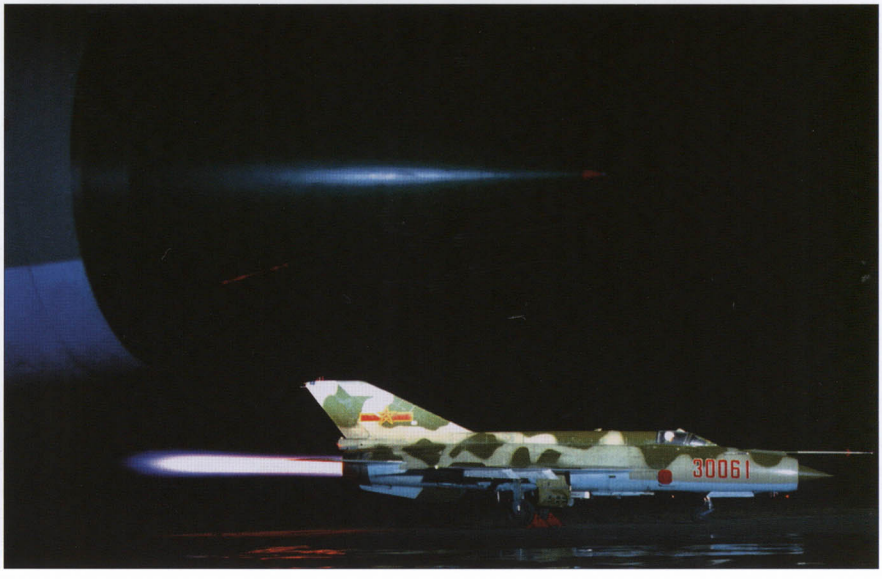
The J-7 III was originally fitted with an SM-8 (HK-03D) optical sight, but this was replaced by a HK-13A head-up display (HUD). Other avionics included a KJ-11 autopilot, an ADS-1 air data computer, a WL-7 radio compass, a Type 264A radio altimeter, a XS-6A beacon marker receiver, a Type 481 data link/radio navigation system, a Type 506 HF radio, a Type 605A IFF transponder, a Type 930-II radar warning receiver (RWR) and a GT-1 chaff/flare dispenser.

The armament included a 23-mm (.90 calibre) Type 23-III twin-barrel cannon (a Chinese copy of the GSh-23L) with 200 rounds. Like the F-7M, the J-7 III (J-7C) had four wing pylons; these were used for carrying four PL-2 or PL-5 IR-homing short-range AAMs (the latter

▲ **J-7C '30161 Red' undergoes maintenance at Huairen AB, the home base of the 15th Division.**

www.DefenceTalk.com

▶ **This night shot of '30063 Red' shows that the J-7C's navigation lights are located at the wingtips, not in line with the wing fences as on the MiG-21MF.**



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▶ **J-7C '30061 Red' ground-runs the engine in full afterburner for the benefit of the photographer (note the chocks in front of the mainwheels).**

via Internet

◄
Another camouflaged 15th Division J-7C shows the characteristic shape of the brake parachute housing.

China Aircraft 1951-1997

◄
One more operator of the J-7C was the PLAAF 29th Division. Here, two of its J-7Cs in air superiority grey finish touch down in ferry configuration.

29th Division J-7Cs parked at Quzhou AB.
▼

Some 15th Division J-7Cs also wore the overall grey finish.
▼▼

model is a cross between the AIM-9B and the AIM-9G), free-fall bombs, or rocket launcher pods with 57-mm, 90-mm or 130-mm FFARs. The outer pylons were 'wet', permitting the carriage of 480-litre drop tanks.

Development began in May 1979 and was completed by May 1980. For the first time the Chinese aircraft industry made use of computer-aided design (CAD) and system engineering management when reverse-engineering the J-7 III; this was performed by Design Institute No. 611 in 1981. The first airframe was assembled in February 1984, completing its static testing in April that year. The first prototype J-7 III performed its maiden flight on 26th April 1984, with Yu Mingwen at the controls. The aircraft was painted grey overall and serialled '151 Red' at the time; later it received a red/white/black demonstrator colour scheme. Still later it became '950151 Red' and wore a red/white/blue demo livery before gaining a dark green/dark earth camouflage scheme.

After a protracted development and test programme the J-7C entered service in 1992. Yet the fighter did not live up to the PLAAF's expectations. For one thing, it was considerably heavier and consequently less agile than the basic J-7 II; for another, the JL-7 radar was unreliable and lacked beyond visual range (BVR) combat and 'look-down/shoot-down' capability which was commonly found on contemporary

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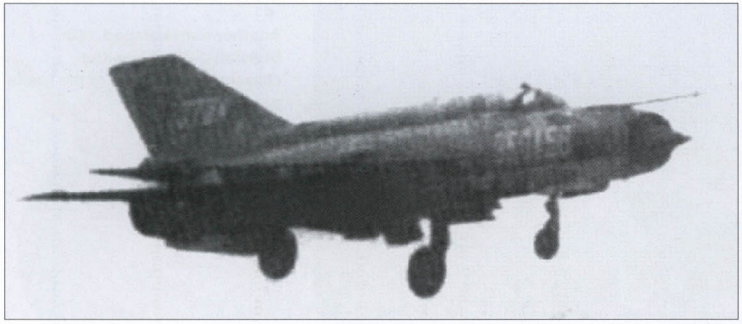


▲
'950156 Red', one of the J-7 IIIA prototypes.

▶
J-7 IIIA '950155 Red' (seen here with two wing pylons) also had appropriate tail titles.

'50156 White', one of the J-7 IIIA (J-7 IV) prototypes, with PL-5 AAMs outboard and PL-8 AAMs inboard. The lop-sided PLAAF 'star and bars' insignia indicate the picture has been retouched.
▼

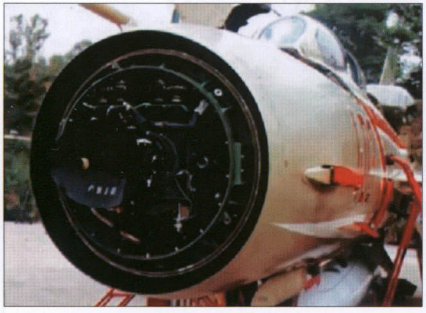
Chengdu F-7-3 Tactical Fighter

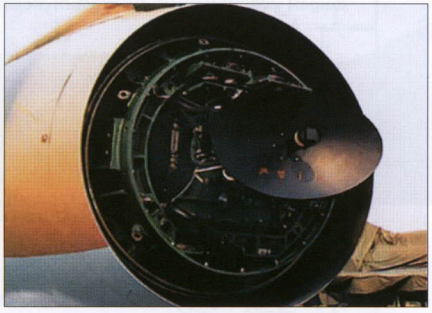
The J-7 III was offered for export as the F-7-3; the export model had different missile rails compatible with the Matra R.550 Magic AAMs. No sales have been achieved.

Chengdu J-7 IIIA (J-7 IV, J-7D) Tactical Fighter

In response to the J-7C's weaknesses, CAC and GAIC began an upgrade programme in the early 1990s. The resulting aircraft was initially known as the J-7 IIIA, later becoming the J-7 IV and ultimately the J-7D. The improvements focused on the avionics: the J-7 IIIA had a revised JL-7A radar, an HK-13A HUD, a JD-3 II tactical aircraft navigation (TACAN) system, a Type 563B inertial navigation system (INS), a KJ-8602 RWR and TKR-122 VHF radio. The fighter was powered by Western and Russian fighters. Low-rate production continued until 1996 and only about 30 examples were built. The J-7C saw limited service as a dedicated night fighter with the PLAAF's 15th Air Division at Huairen AB and the 29th Air Division at Quzhou AB.

All photos via Internet





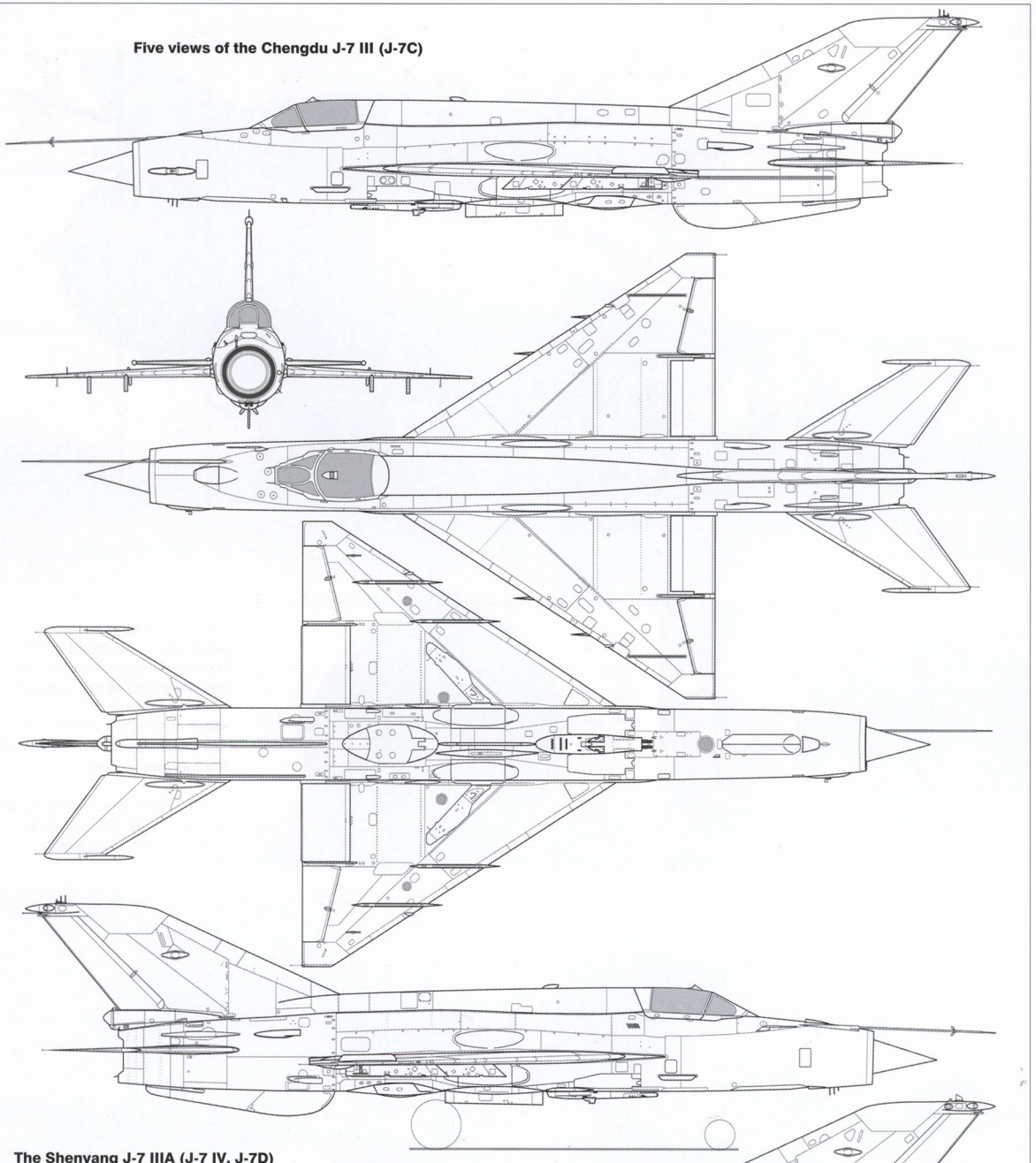
▲
'402 Red', one of the J-7 IV (J-7D) prototypes operated by CFTE. Note the undernose blade aerial characteristic of this version.

◄
The JL-7A radar of the J-7 IV with the radome removed.

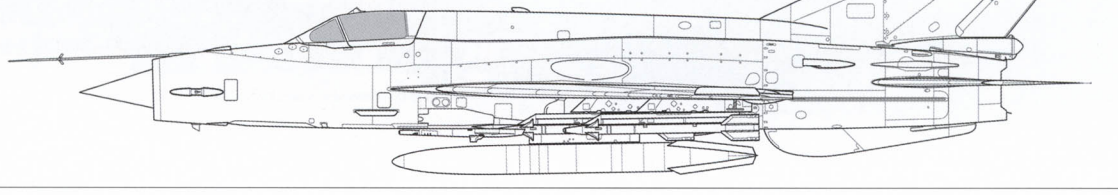
J-7 IV prototypes '401 Red', '402 Red' and '404 Red' all wore different colour schemes.
▼

All photos via Internet

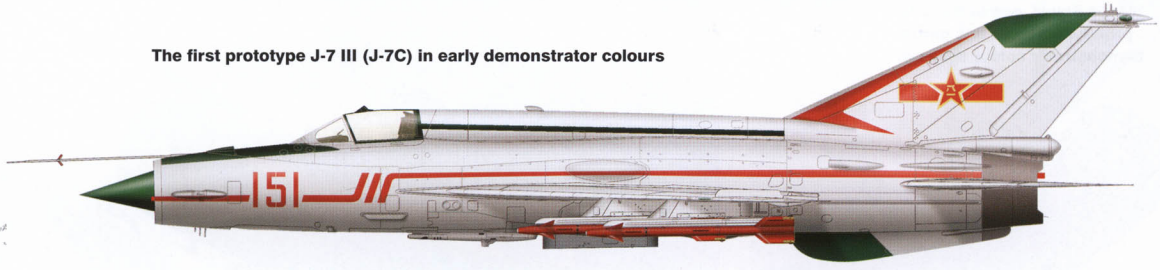
Five views of the Chengdu J-7 III (J-7C)



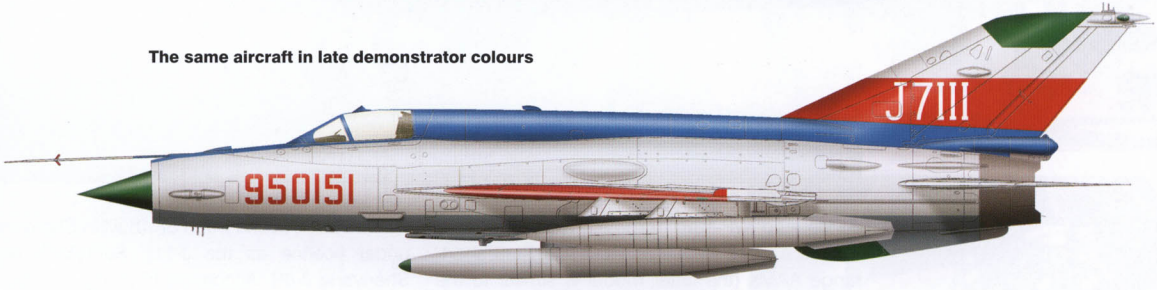
The Shenyang J-7 IIIA (J-7 IV, J-7D)



The first prototype J-7 III (J-7C) in early demonstrator colours



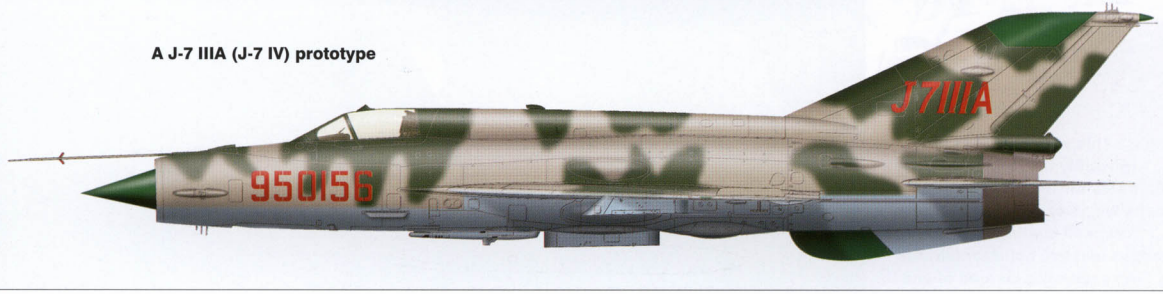
The same aircraft in late demonstrator colours



A production J-7C, PLAAF 15th Division, Huairen AB, Beijing Military Region

A production J-7C, PLAAF 29th Division, Quzhou AB, Nanjing Military Region

A J-7 IIIA (J-7 IV) prototype



'95154 Black', one of the J-7E prototypes, wore this garish demonstrator colour scheme.

an uprated WP-13F1 turbojet. The J-7D could carry the more advanced PL-7 and PL-8 short-range AAMs (the latter model is similar to the Israeli Rafael Python 3) but still lacked BVR combat capability.

Development began in 1988, and the fighter first flew on 20th August 1991. The trials programme involved six prototypes serialled '401 Red' through '404 Red', '950155 Red' and '50156 White' (later '950156 Red'). All six aircraft sported different camouflage schemes. '950155 Red' and '950156 Red' acted as demonstrators, wearing 'J7IIIA' tail titles.

The J-7D was cleared for production in November 1994 and achieved initial operation capability in 1995. By then, however, the PLAAF had already placed its bets on more capable fighters such as the Su-27SK (built in Shenyang under licence as the J-11), Su-30MKK and Shenyang J-8B. According to media reports, a production batch of twenty or thirty J-7Ds was built before production finally stopped in 1999, but this is unconfirmed.

Chengdu F-7D Tactical Fighter

In similar manner to the F-7-3, the J-7D was offered for export as the F-7D with provisions for carrying Matra R.550 Magic AAMs. No sales have been achieved.

Chengdu JZ-7 Tactical Reconnaissance Aircraft

A tactical photo reconnaissance version of the J-7 II was brought out as the JZ-7 (*jianjiji zhenchaji*

This view of '95153 White' (possibly the first prototype) illustrates the J-7E's new double-delta wings of greater span with cranked leading and trailing edges and two actuator fairings on each wing instead of one.

All photos via Internet

– reconnaissance fighter); this was the Chinese counterpart of the Soviet MiG-21R. In addition to the aerial camera, the JZ-7 could carry an indigenous electronic intelligence (ELINT) pod and was the first PLAAF aircraft to do so.

Chengdu Sabre II Tactical Fighter (Project)

As a follow-on to the stillborn Super-7 project described earlier, the Northrop Corp. (now Northrop Grumman) devised an F-7P upgrade for the Pakistani Air Force. The aircraft was extensively redesigned, featuring a conventional ogival radome housing a General Electric AN/APG-67 fire control radar as fitted to the Northrop F-20 Tigershark fighter. The engine breathed through lateral intakes in the wing roots, and the wings featured wingtip missile rails and small leading-edge root extensions (LERXes). The programme was terminated after the student unrest in Beijing's Tiananmen Square in 1989 which was ruthlessly squashed, causing sanctions to be imposed on China. Eventually, however, the project evolved into the FC-1/JF-17 programme.

▲▲
Grey-painted PLAAF J-7Es flown by the 4th Division/10th Regt ('10158 Red' and '10159 Red'), 3rd Division/7th Regt ('11245 Red') and 5th Division/15th Regt ('12263 Red').

▲►
The cockpit of the J-7E.

J-7Es of the PLAAF 2nd Division/5th Regiment at Liuzhou.
▼

All photos via Internet

via Internet

▲ **A pair of J-7EHs (naval J-7Es) operated by the 4th Naval Division/10th Regiment patrols the skies, carrying PL-2 AAMs and drop tanks. The lack of wing fences and of the portside cannon is evident.**

Chengdu J-7E Tactical Fighter

The failure of the J-7 III programme was a disappointment, but not a fatal blow to Chinese aspirations to improve the J-7. In 1987 the Chengdu Aircraft Industrial Corp. (CAC) began development of a further version designed to supersede the J-7 II/F-7B. Designated J-7E (the numeric version designators of domestic versions appear to have been dropped by then), the aircraft introduced a host of improvements concerning aerodynamic performance and avionics.

The most important change was the new wings of double-delta planform similar to that of the Sukhoi Su-15TM *Flagon-F* and the SAAB J-35 Draken. The leading-edge sweep was reduced from 57° to 42° on the cambered outer wing portions, which now incorporated leading-edge flaps; the kink was just outboard of the inboard wing pylons. The trailing edge was also kinked, with forward sweep outboard of the flaps; there were two actuator fairings on the upper wing surface each side instead of one (for the aileron and flap) and the boundary layer fences were deleted. The wing span increased from 7.15 m to 8.32 m (from 23 ft 5½ in to 27 ft 3½ in), while gross wing area was increased 8.17% – from 23.00 to 24.88 m² (from 247.6 to 267.8 sq ft). This design offered much-enhanced manoeuvrability and field performance. In addition, the wings were 'wet', incorporating integral tanks; this doubled the internal fuel load as compared to the J-7 IIA – from 2,080 to 4,165 kg (from 4,585 to 9,180 lb).

The J-7E was powered by a WP-13F afterburning turbojet delivering 4,500 kgp (9,920 lbst) at full military power and 6,600 kgp (14,550 lbst) in full afterburner. (Some sources state a different powerplant – the slightly less powerful WP-7F with an identical dry rating and a 6,500-kgp (14,330-lbst) afterburner rating.) The new engine gave a thrust/weight ratio of about 0.9 in 'clean' take-off configuration compared with 0.8 for the J-7 IIA.

The fighter was fitted with a Type 226 pulse-Doppler radar (apparently a copy of the GEC-Marconi Skyranger) for the home market or a GEC-Marconi Super Skyranger or FIAR Grifo 7 radar for export. The avionics suite included a JT-1 HUD, a KW8602 radar warning receiver (RWR), a Type 8430 air data computer, a JD-3 TACAN system and a KG-8605 built-in active jammer. A Type 941-4AC chaff/flare dispenser was fitted for self-defence. The J-7E was the first Chinese fighter to incorporate the hands-on-throttle-and-stick (HOTAS) concept, which became standard on later versions of the J-7.

The built-in armament was restricted to a single 30-mm Type 30-1 cannon with 60 rounds on the starboard side. The four wing pylons could carry up to 2,000 kg (4,410 lb) of ordnance. Typical weapons included PL-5 or PL-8 short-range AAMs, 50-/100-/250-/500-kg (110-/220-/551-/1,102-lb) free-fall bombs, and FFAR pods holding twelve 55-mm (2.16-in) or seven

J-7EH, PLANAF 4th Naval Division/10th Regiment, Luqiao AB
81047
A J-7E prototype, Chengdu Aircraft Corp.
95153
J-7E, PLAAF 4th Division/10th Regiment, Dalian, Beijing Military District
10055
J-7E, PLAAF 3rd Division/7th Regiment, Wuhu, Nanjing Military District
11245

90-mm (3.54-in) unguided rockets each. The two outboard pylons were plumbed for carrying 480-litre drop tanks.

The designers made large-scale use of new technologies, including computer-aided design and manufacturing (CAD/CAM), numerical control processing, laser/electromagnetic tests, composite materials, and high-pressured water cuts when developing the J-7E. This resulted in a much finer external finish as compared to the early models of the J-7.

The J-7E prototype made its first flight in May 1990. Flight tests showed that the rate of climb at sea level had increased from the J-7 IIA's 155 m/sec (30,500 ft/min) to 195 m/sec (38,380 ft/min); the ferry range increased from 1,500 to 2,200 km (from 931 to 1,366 miles), and the operational G limit was increased from +7 to +8. The maximum instantaneous turn rate was 25.2 deg/sec, and the maximum sustained turn rate at 1,000m altitude was 16 deg/sec.

Yefin Gordon archive

via Internet

▲
'05 Red', a J-7EB operated by the PLAAF's 'August 1st' aerobatic team, in the original red/white livery. The trailer is a starter cart with batteries.

◄
J-7EB '09 Red' undergoes pre-flight checks. Note the square-tipped blade aerial.

The team is ready to taxi out for a display routine.
▼◄

A publicity photo for the 'August 1st' team.
▼

via Internet

via Internet

Yefim Gordon archive

▲
Two of the team's J-7EBs on take-off. Note the absence of cannons characterising the aerobatic version. This view shows well the J-7EB's distinctive ventral pod holding an oil/dye mixture for the smoke generator.
▼

Yefim Gordon archive

▲ **The badge worn by the personnel of the PLAAF's 81st Display Team ('August 1st').**

The flight tests were completed by 1992 and the existence of the J-7E was officially revealed that year. Quantity production began shortly after. The fighter entered PLAAF and PLANAF service in 1995, allowing the bulk of J-6 and J-7 II fighters in current service to be phased out. The J-7E remained in production until replaced on the production line by the J-7G in 2002-03; several hundred were delivered to the Chinese PLA and foreign customers (export versions are dealt with separately).

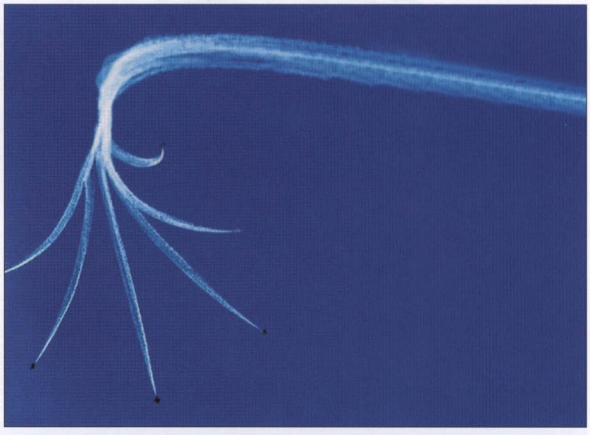
According to CAC, the J-7E's overall performance was increased by 43% as compared with the J-7B, while combat effectiveness was increased by 84%. The J-7E demonstrated that Chinese aeronautical engineering had reached a certain level of maturity and was able to produce innovative and effective designs instead of just copies of existing foreign machines. Pilots who have flown it said the fighter is comparable in many respects to the early US General Dynamics F-16A.

Chengdu J-7EB Aerobatic Aircraft

A special version of the J-7E was developed for the PLAAF's '1st August' display team (thus named to honour the day when the People's Liberation Army was established), which had previously flown a special version of the Chengdu JJ-5 jet trainer. Designated J-7EB, the aircraft was stripped of armament, including the wing pylons, and fitted with a smoke generator. The centreline pylon carried a cylindrical tank filled with a mixture of diesel fuel and dye; when fed into the engine this created a thick smoke trail, adding to the impression created by the aerobatics.

A dozen J-7EBs were delivered to the team. Originally they sported the same basic red/white livery as worn by their predecessors and carried the codes '01 Red' through '12 Red' on their noses. Later the team adopted a new blue/white livery and the codes were applied in white on the tails. The J-7EB remained the team's standard equipment until the team reequipped with the more modern J-7GB.

J-7EB, PLAAF 24th Division/81st Display Team ('August 1st'), Yangcun AB

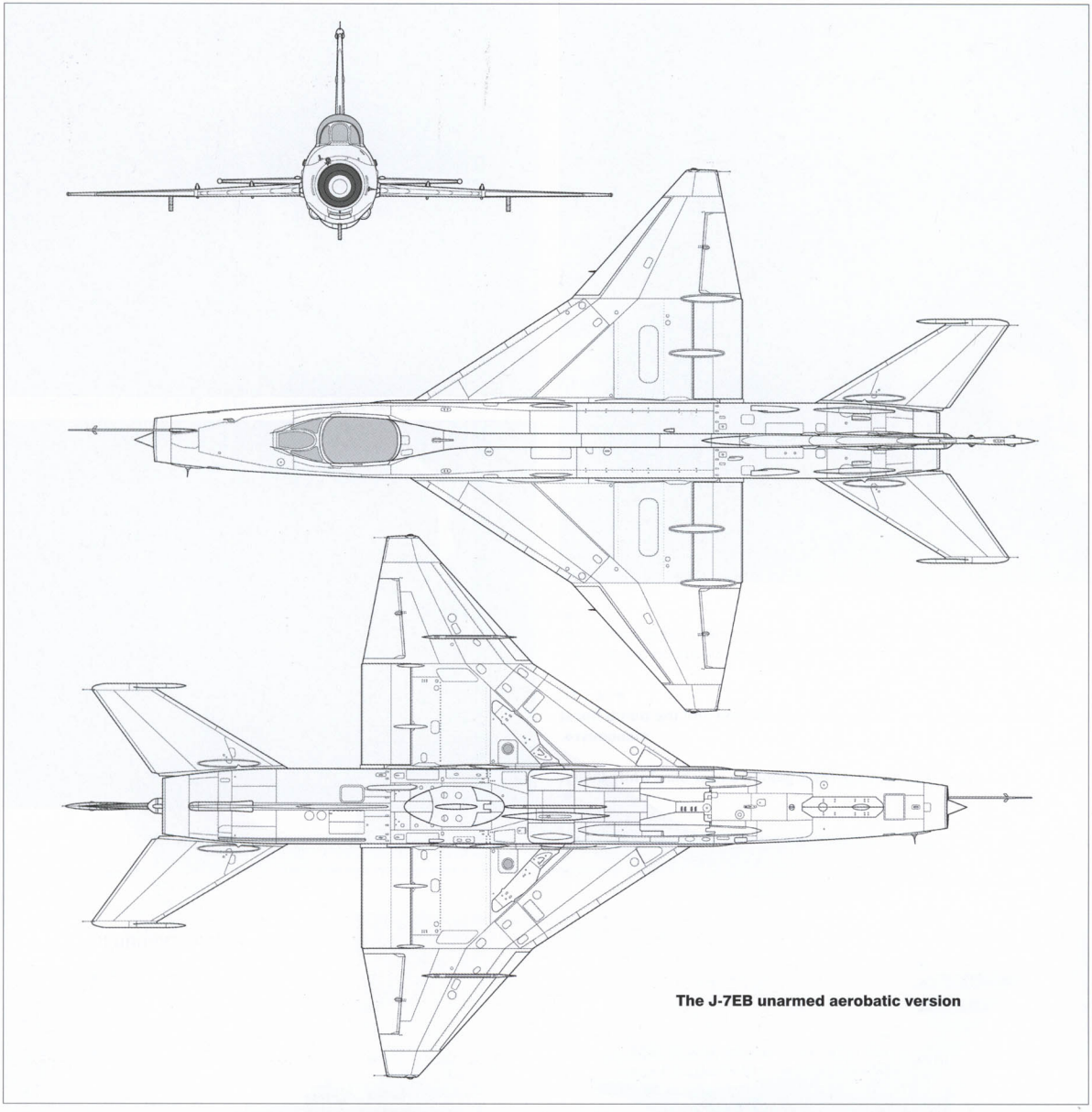


▲
The red/white J-7EBs make a turn in delta formation as a member of the 'August 1st' team comments on the display.

►▲ ►
The team performs a loop in arrow formation and the Bomb Burst manoeuvre.

Later, the team's J-7EBs gained a new blue/white livery.
▼

All photos via Internet



The J-7EB unarmed aerobatic version

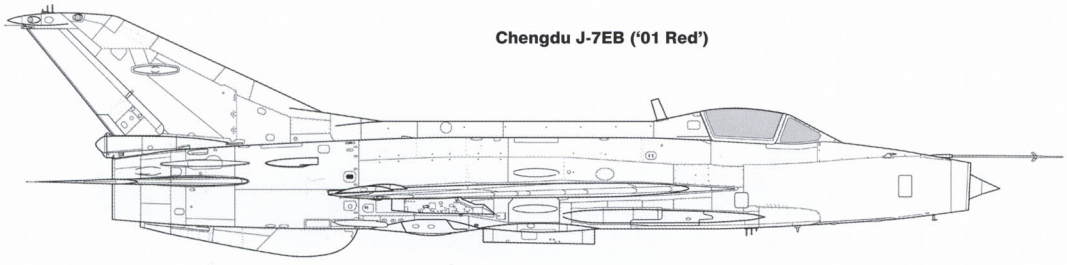
Chengdu J-7EH Naval Tactical Fighter

A special version based on the J-7E was evolved for the PLANAF; it was capable of carrying anti-shipping missiles such as the turbofan-powered YJ-2 (alias C-802; YJ stands for *Ying Ji* – 'eagle strike'). The aircraft was designated J-7EH; the H suffix again denoted *hongzhaji* – strike aircraft. However, the limitations of its radar do not allow the J-7EH to engage shipping targets independently; after launch the anti-ship missile is passed on to another aircraft acting as a target designator, such as the Shaanxi Y-8X (Y-8MPA) maritime patrol aircraft or the Harbin SH-5 flying boat.

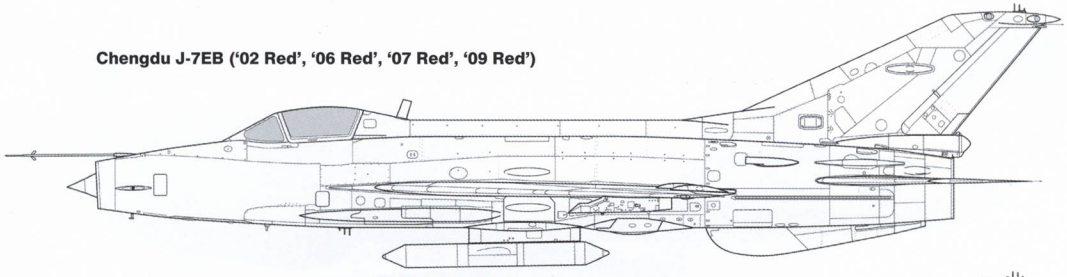
Chengdu J-7MG Tactical Fighter

The designation J-7MG was used for the demonstrator of the J-7E's export version fitted with a Martin-Baker ejection seat. Pakistan and Bangladesh evaluated the aircraft and were pleased with it, ordering the F-7MG version (see next entry).

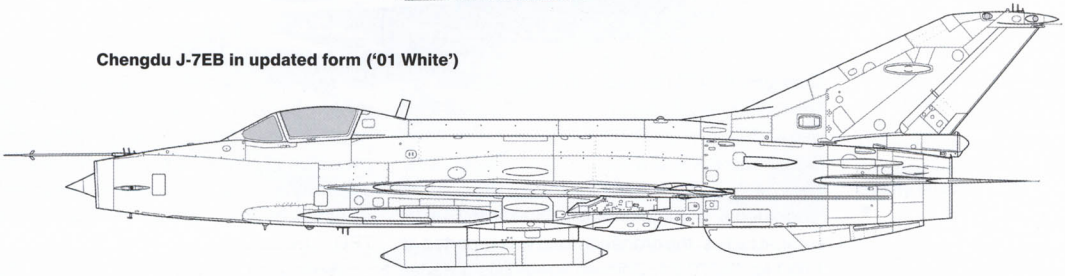
▶ **J-7EBs in the new livery undergoing maintenance.**



Chengdu J-7EB ('01 Red')

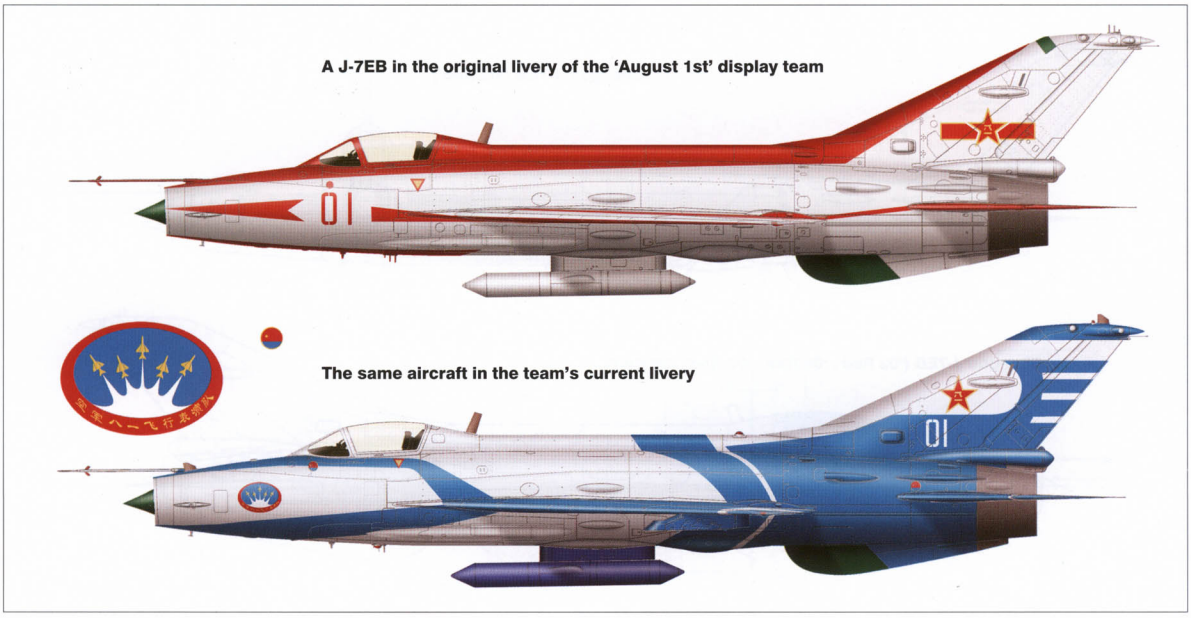


Chengdu J-7EB ('02 Red', '06 Red', '07 Red', '09 Red')



Chengdu J-7EB in updated form ('01 White')

Yefin Gordon archive



Chengdu F-7MG Tactical Fighter

The F-7MG was the export version of the J-7E fitted with a GEC-Marconi Super Skyranger radar, Allied Signal avionics and a Martin-Baker ejection seat. The G suffix stood for *gai* (Chinese for 'modified' or 'upgraded'). The fighter had a 850-km (527-mile) combat radius; the ordnance load was reported as 1,800 kg (3,970 lb). Chinese specialists asserted that, as compared to the F-7M, the F-7MG's agility was improved by 43%; overall combat efficiency in air superiority mode was 83.9% higher and the rate of climb was 24% higher. The take-off and landing distances were 30% and 28.6% shorter respectively. The pilot workload was reduced thanks to the more efficient cockpit layout with improved ergonomics.

At least three prototypes (CAC 0142, CAC 0143 and CAC 0144) were involved in the trials. Interestingly, the first two aircraft retained the old cropped-delta wings at the initial stage of the programme, being in effect systems testbeds. CAC 0142 was later converted to full F-7MG standard by fitting the definitive double-delta wings but CAC 0143 was not.

CAC 0144 made the F-7MG's public debut at one of the Zhuhai airshows, performing an aerobatics display with compact smoke generator pods under the wingtips. Originally all three aircraft had the standard three-piece windshield with a flat bulletproof windscreen. Later, however, CAC 0142 was refitted with a one-piece curved birdproof windshield as used on most of today's fighters; after passing its test programme successfully the new design became a standard fit on the F-7MG. Another peculiarity of CAC 0142 was the provision of a second cannon on the port side, J-7 I style; this twin-cannon armament was selected by the Pakistani Air Force for the F-7PG (see below).

Aiming to increase the F-7MG's combat radius and endurance, CAC proposed fitting the fighter with conformal fuel tanks. An artist's impression shows large teardrop-shaped tanks running along the fuselage sides all the way from the cockpit to the fuselage break point, partially obstructing the flaps.

Chengdu F-7PG Tactical Fighter

The Pakistani Air Force evaluated the F-7MG at Chengdu in July 1997; PAF pilots flew 12 sorties to explore the new fighter's flight envelope and assess the improvements in performance as compared to the in-service F-7P. After that, the PAF requested a number of changes to the design before placing an initial order for 50 aircraft which was subsequently followed by a second order for 30 (some sources say that only 48 were ordered). Designated F-7PG, the Pakistani version featured a FIAR Grifo MG fire control radar instead of the usual GEC-Marconi Super Skyranger (hence the G). As compared to the earlier Grifo Mk II used on the F-7P, the new model had sector of scan increased to ±30°, as well as better ECCM, look-down and shoot-down capabilities. Like the earlier model, the

via Internet

◄
One of the F-7MG prototypes, CAC 0144, sits on the factory apron at Chengdu amidst an array of weapons (including Sidewinder AAMs), with unpainted J-7Es awaiting delivery in the background. Two cannons are displayed, although CAC 0144 has only one cannon.
▼◄

via Internet

This view of the same aircraft shows the J-7E-type double-delta wings that became standard for the F-7MG. The drooped leading-edge flaps are clearly visible.
▼

China Aircraft 1951-1997

via Internet

via Internet

via Internet

◄▲ Two more views of F-7MG CAC 0144; note the absence of the portside cannon.

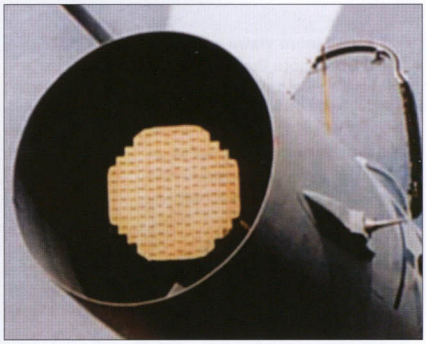
► CAC 0144 performs a roll at an airshow, with smoke generator pods fitted to the wingtips.

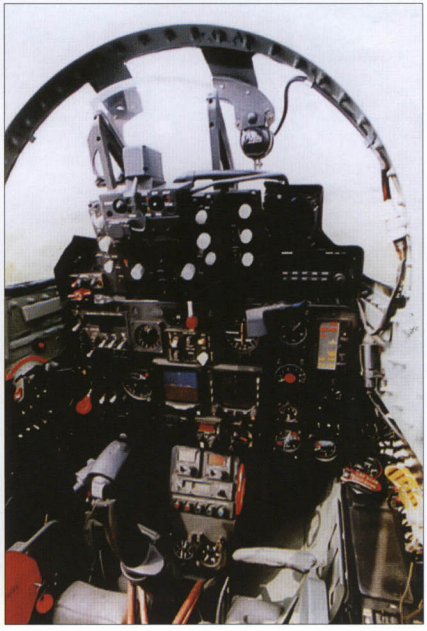
◄ These views show the difference between CAC 0144, which had double-delta wings. and F-7PG CAC 0143, which was a systems testbed retaining F-7M-type delta wings with four pylons.

F-7MG CAC 0143 in later guise. ▼

Yefin Gordon archive

via Internet





All photos via Internet

The F-7P demonstrator (see page 283)

F-7MG CAC 0143 with delta wings after repaint as the F-7PG demonstrator

F-7MG prototype CAC 0144

F-7MG prototype CAC 0142 in late configuration with double-delta wings

radar was to be assembled under Italian licence at the KARF facility in Kamra. Unlike all other double-delta versions, the F-7PG had the twin-cannon armament seen on F-7MG CAC 0142 as standard.

One of the F-7MG development aircraft, CAC 0143, was repainted as the F-7PG demonstrator, retaining the old wings and single cannon. Deliveries of production F-7PGs began in June 2001 to replace the Shenyang F-6Cs flown by the PAF's No. 17 and No. 23 Sqns.

▲▲◀
Another F-7MG prototype, CAC 0142, with the definitive double-delta wings.

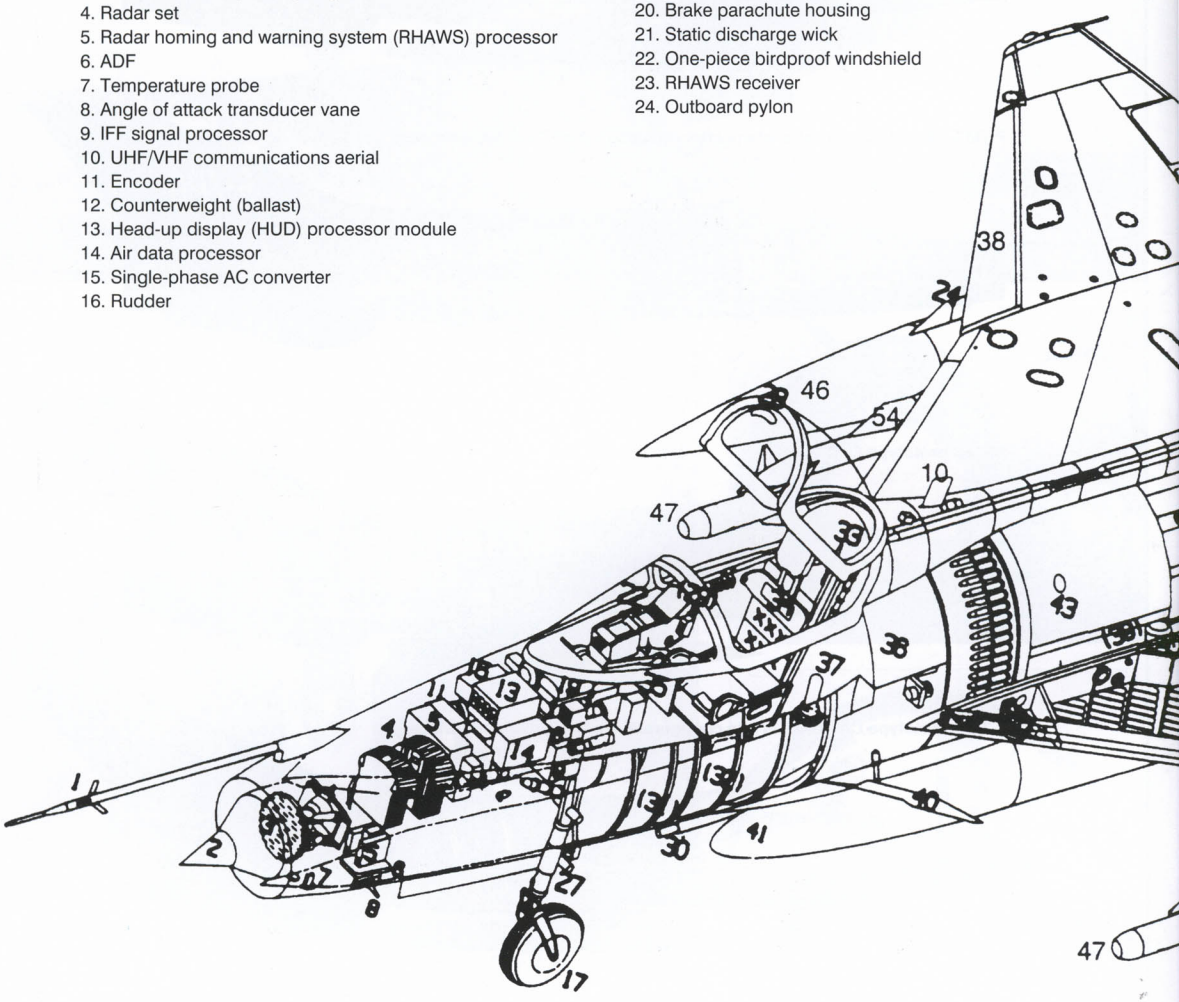
◀◀
CAC 0142 with a weapons array. This aircraft indeed had two cannons.

▲◀
An F-7MG prototype with the radome removed to expose the scanner of the FIAR Grifo MG radar.

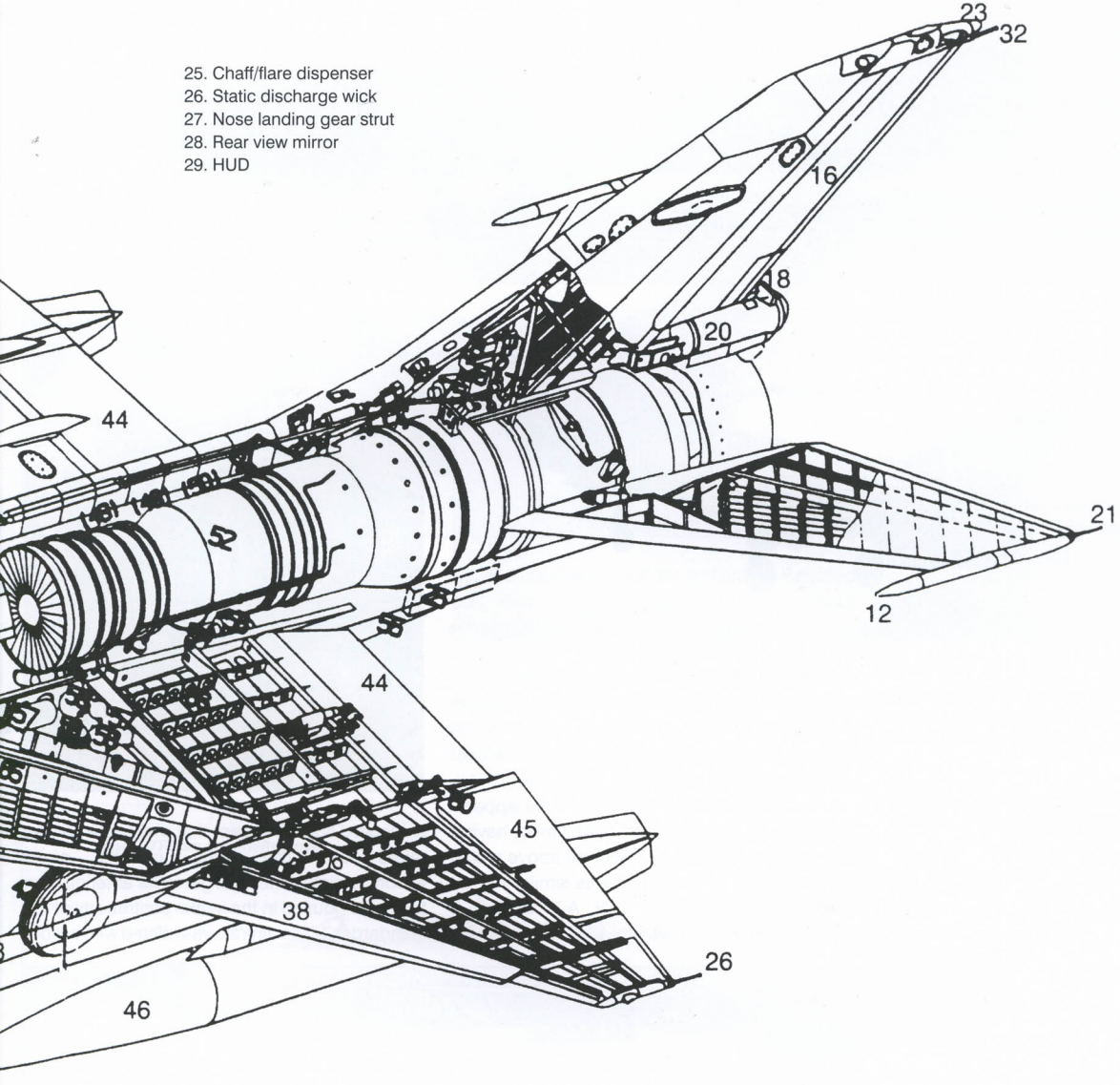
◀
The cockpit of the F-7MG.

Chengdu F-7MG cutaway drawing key

1. Pitot boom with pitch and yaw transducer vanes
2. Air intake centrebody/radome
3. GEC-Marconi Super Skyranger radar scanner
4. Radar set
5. Radar homing and warning system (RHAWS) processor
6. ADF
7. Temperature probe
8. Angle of attack transducer vane
9. IFF signal processor
10. UHF/VHF communications aerial
11. Encoder
12. Counterweight (ballast)
13. Head-up display (HUD) processor module
14. Air data processor
15. Single-phase AC converter
16. Rudder
17. Non-braking nosewheel
18. ILS beacon receiver
19. Gyro compass
20. Brake parachute housing
21. Static discharge wick
22. One-piece birdproof windshield
23. RHAWS receiver
24. Outboard pylon



30. Port 30-mm Type 30-1 cannon
31. DC batteries
32. Static discharge wick
33. Cockpit canopy
34. Martin Baker Mk 10L zero-zero ejection seat
35. Instrument panel
36. Forward fuselage fuel tanks
37. Fuel pump
38. Leading-edge flap
39. Pressure refuelling connector
40. Airbrake
41. 720-litre (158.4 Imp gal) centreline drop tank
42. Mainwheel
43. Centre fuselage fuel tank

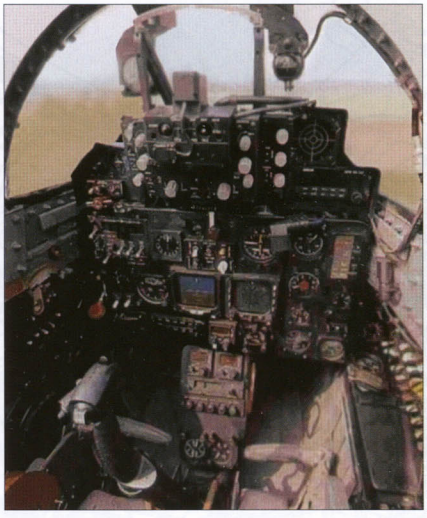


25. Chaff/flare dispenser
26. Static discharge wick
27. Nose landing gear strut
28. Rear view mirror
29. HUD

44. Trailing-edge flap
45. Aileron
46. 480-litre (105.6 Imp gal) underwing drop tank
47. AIM-9 Sidewinder air-to-air missile
48, 49. Fuselage fuel tanks
50. Hydraulic tank
51. Control system push-pull rods
52. Liming WP-13F afterburning turbojet
53. Aileron actuator fairing
54. Inboard pylon
55. Ventral fin
56. Hydraulic pump
57. Oxygen bottle
58. Missile launch rail

All photos via Internet

▲ **In due course F-7MG CAC 0143 was repainted as the F-7PG upgrade demonstrator.**



▶ **The F-7PG's cockpit is virtually identical to that of the F-7MG.**

Chengdu J-7FS Development Aircraft

In the late 1990s CAC developed a version designated J-7FS. This was meant as a technology demonstrator for a low-cost and yet effective upgrade package for the existing J-7 II.

The J-7FS differed markedly in its appearance from all other versions of the family, having a large conical radome positioned above a chin air intake. The arrangement was similar to that used on the American LTV A-7 Corsair II shipboard strike aircraft and LTV F-8 Crusader shipboard fighter, except that the intake lip was raked aft. The large radome could accommodate a much larger radar antenna than the radar housed in the intake centrebody of the standard J-7. The aircraft was refitted with a more

▶ **The J-7FS development aircraft in its original guise with standard wings and vertical tail. Note the lack of cannons.**

All photos via Internet

◄▲ **The J-7FS shows off its bizarre nose design.**

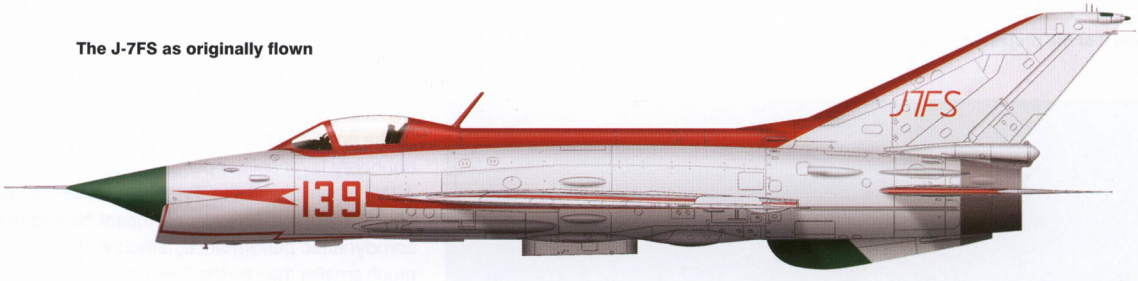
▲ **The same aircraft a few seconds before touchdown.**

◄ **The J-7FS in late configuration showing off the new double-delta wings and the revised fin cap.**

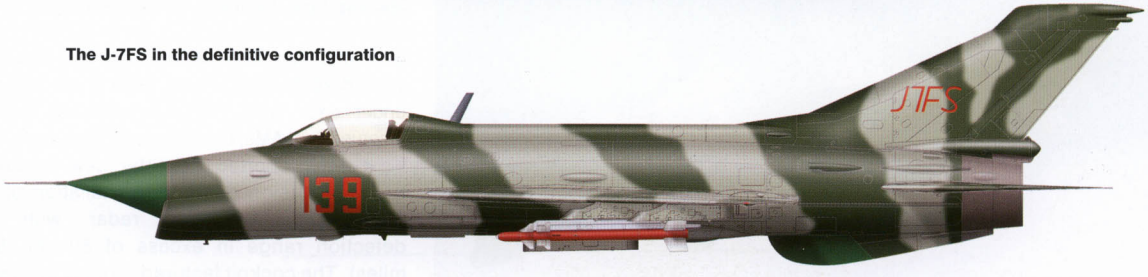
powerful WP-13 IIS engine, a cooling system for the radar and other avionics, and a GPS navigation receiver. The cannons were deleted. The other airframe components and systems (including the nose gear unit retracting into the intake splitter) remained unchanged.

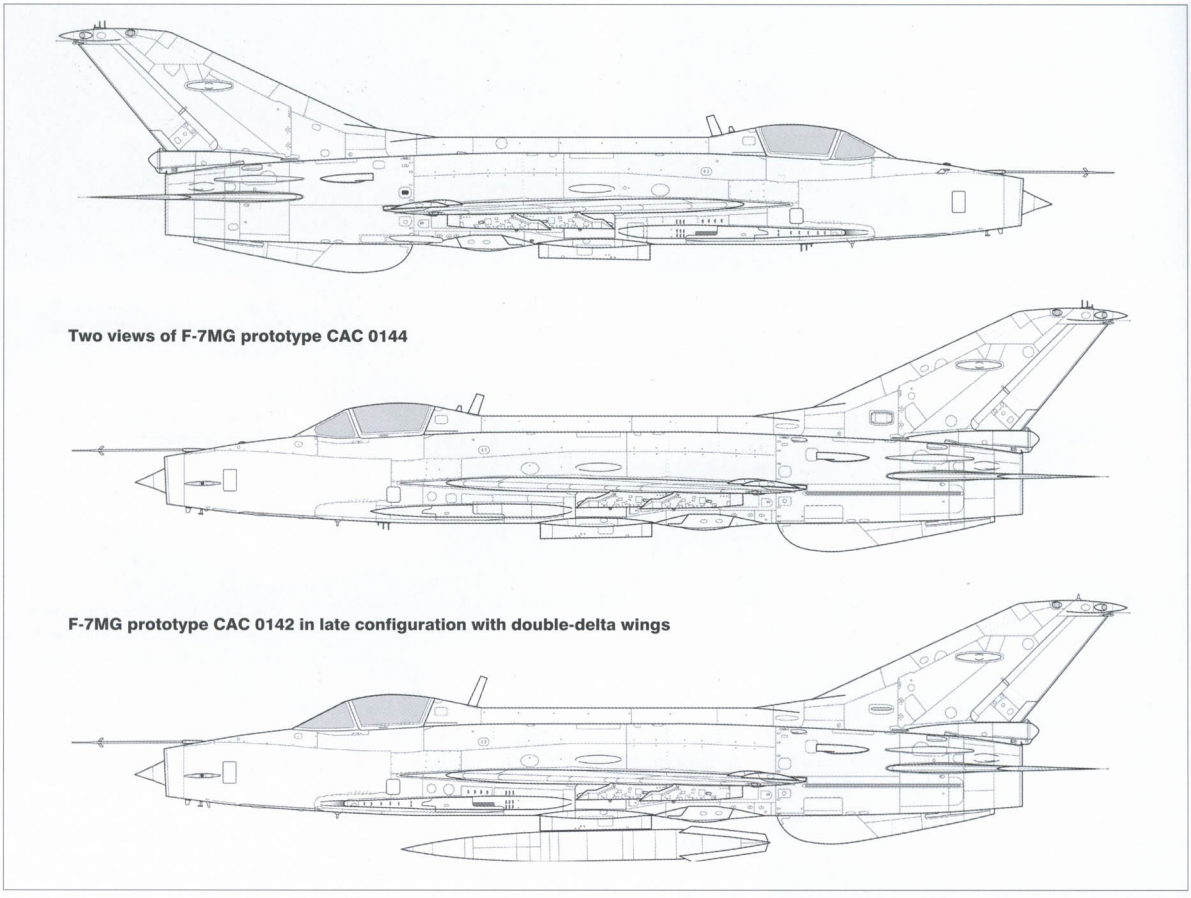
Two second-hand J-7 II airframes were converted to J-7FS prototypes – one for flight test and the other as a static test article. Serialled '139 Red' and wearing a red/white colour scheme reminiscent of the 'August 1st' display team, the sole prototype first flew on 8th June 1998. In the course of the trials the aircraft was refitted with double-delta wings borrowed from the J-7E and the fin cap was modified in a manner vaguely reminiscent of the Lockheed

The J-7FS as originally flown



The J-7FS in the definitive configuration





Two views of F-7MG prototype CAC 0144

F-7MG prototype CAC 0142 in late configuration with double-delta wings

Martin F-16; the aircraft gained a dark green/sand camouflage in so doing. Eventually the programme was abandoned in favour of the more promising J-7MF project (see below).

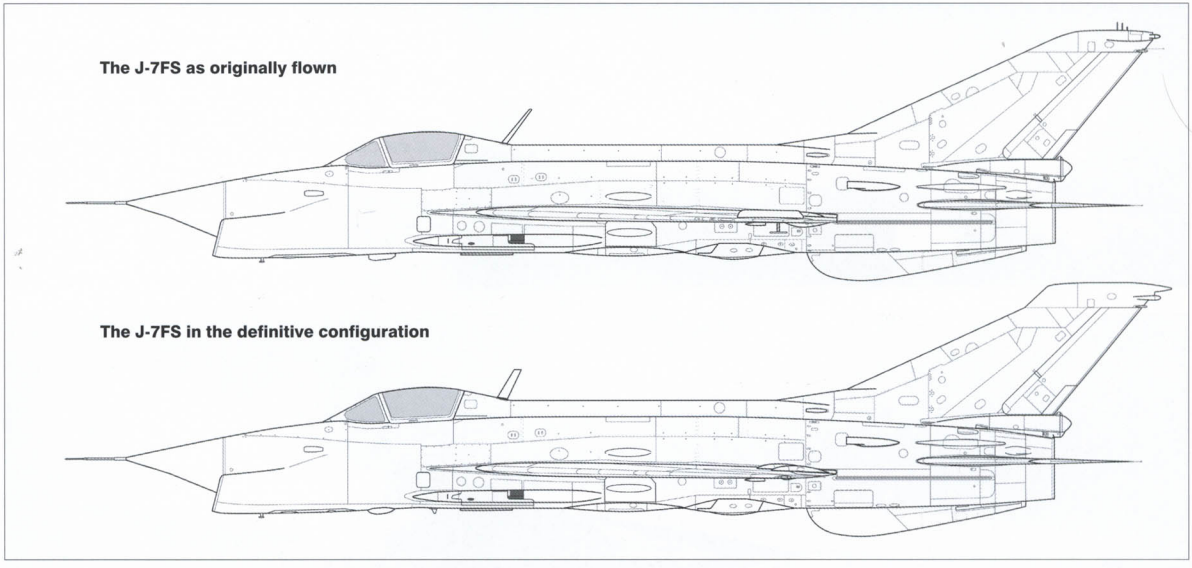
A model of the projected F-7MF. ▼

via Internet

Chengdu J-7MF Tactical Fighter (Project)

This projected export model revealed in 2002 was an extensive redesign of the J-7E featuring a forward fuselage strongly reminiscent of the Eurofighter EF2000 Typhoon II – or the CAC J-10, with a large ogival radome and a boxy ventral air intake positioned well aft, its upper lip acting as a boundary layer splitter plate. Another feature the J-7MF shared with the Typhoon II was the all-movable canard fore-planes meant to improve aerodynamic performance, although these were much smaller than on the Typhoon II. The vertical tail was new, featuring less sweepback and a wider chord. As distinct from the J-7FS, the nose gear unit had twin wheels and retracted aft instead of forward. There were three pylons under each wing, the outermost pair being reserved for AAMs; the centre pair was 'wet'.

It was reported that the new forward fuselage design permitted installation of a modern pulse-Doppler radar with a detection range in excess of 80 km (50 miles). The cockpit featured an HUD and two



The J-7FS as originally flown

The J-7FS in the definitive configuration

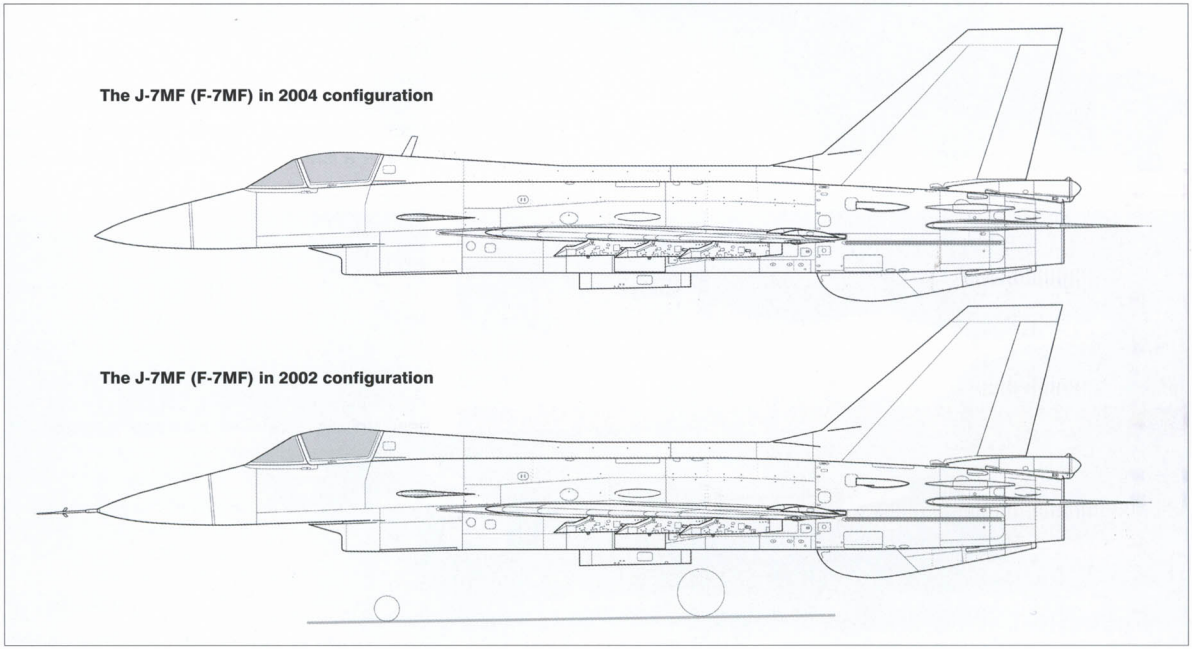
multi-function displays, plus HOTAS control. As of mid-2002 extensive wind tunnel tests had reportedly been undertaken. The project did not reach the hardware stage.

Chengdu F-7MF Tactical Fighter (Project)

Italy proposed an export version of the J-7MF equipped with the proposed FIAR Grifo M radar and called F-7MF. The plan was abandoned in favour of the Chengdu FC-1 (JF-17).

Chengdu F-7X Multi-Role Export Fighter (Project)

Taking this line of development further, CAC proposed the F-7X multi-role fighter intended for the foreign market. Actually very little is left of the original F-7 in this project; the radome, the canopy and the two-dimensional ventral air intake are all similar to those of the Typhoon II, while the tail surfaces bear a striking resemblance to those of the F-16. In particular, the



The J-7MF (F-7MF) in 2004 configuration

The J-7MF (F-7MF) in 2002 configuration

via Internet

single curved ventral fin is replaced by two canted trapezoidal fins and the brake parachute is housed in a much larger boxy fairing akin to that of European F-16s. The wings do retain a likeness to those of the F-7M (that is, a cropped-delta shape with a straight trailing edge) but feature large scimitar-shaped LERXes; there are no canards this time. There are four wing hardpoints; an artist's impression shows the F-7X carrying what appears to be a Raytheon AIM-120 AMRAAM

www.DefenceTalk.com

www.DefenceTalk.com

medium-range missile – or a Chinese PL-11 (LY-60) AAM.

Chengdu J-7G Tactical Fighter

An improved variant of the J-7E entered flight test in 2002. Designated J-7G (the suffix probably again stood for *gai*, modified), the fighter featured a new KLJ-6E pulse-Doppler radar – a Chinese copy of Italian Pointer-2500

www.DefenceTalk.com

www.DefenceTalk.com

www.concentric.net

www.concentric.net

www.stormpages.com

www.concentric.net

www.concentric.net

▲▲▲◀
An artist's impression of the F-7X.

▲▲◀
A J-7G in primer finish makes a pre-delivery flight. Note the strake aerials on the sides of the fin.

◀
An F-7G with two cannons instead of one.

◀▲ ▲▲▲▲
Brand-new J-7Gs seen during pre-delivery tests with dummy PL-8 AAMs.

▲▲▲
The J-7G prototype in primer with appropriate '7G' titles.

◀ ▲ ▲▲
J-7Gs seen during pre-delivery tests with dummy PL-8 AAMs.

All photos via Internet

▲▲ **J-7G '20137 Yellow' operated by the PLAAF 12th Division/34th Regiment in a non-standard overall blue colour scheme. Note the wide ventral blade aerial not found on many J-7Gs.**

►▲ **This view of a PLAAF J-7G shows the one-piece windshield distinguishing it from the J-7E.**

▲ **A Namibian Air Force F-7NM, still wearing the delivery serial 0310 and large 'F-7NM' titles, at Grootfontein.**

radar (the same model was fitted to the Nanchang Q-5M (A-5M) *Fantan* attack aircraft). The radar itself was derived from the Pointer radar – a licence-built version of the Israeli Elta Electronics EL/M-2001. A licence-built helmet-mounted sight of Russian design was integrated, allowing the J-7G to carry PL-8 AAMs, and a more powerful engine installed. Outwardly the J-7G differed from its predecessor in having a wraparound windshield and anti-collision lights below the cockpit and ahead of the fin.

Production began in 2002, and the J-7G entered service with the PLAAF in 2003.

Chengdu J-7GB Aerobatic Aircraft

The J-7GB was a special unarmed version of the J-7G fitted with a smoke generator. It was developed as a replacement for the J-7EB and is the current equipment of the PLAAF's 'August 1st' display team. Again, twelve examples were delivered to the team, inheriting the codes '01 White' through '12 White'.

Chengdu F-7BG Tactical Fighter

An export version of the J-7G was created to meet a requirement from the Bangladesh Air Force (BAF), receiving the designation F-7BG (by analogy with the F-7PG; the B stood for Bangladesh). Calling it 'F-7GB' by analogy with the F-7MB already in BAF service would create confusion with the unarmed J-7GB, so the order of the suffix letters was reversed. Some sources say the F-7BG was able to carry a reconnaissance pod, like the F-7MB. Deliveries took place in 2005.

Chengdu F-7NM Tactical Fighter

A version of the J-7G for the Namibian Air Force was designated F-7NM (some sources erroneously called it F-7NG). Twelve such aircraft were ordered in August 2005 and delivered in 2006, wearing F-7NM titles.

Chengdu F-7N Tactical Fighter

The F-7N was a simplified version of the old F-7M export model developed for the Islamic Republic of Iran Air Force (IRIAF), which ordered 18 (the N stood for IraN, as the designation 'F-7I' would create confusion with the J-7 I). Because Iran had long since been branded as a 'rogue state' and military equipment supplies had been embargoed, using western avionics was impossible and the F-7N was fitted with Chinese avionics, reportedly including an SY-80 pulse-Doppler radar.

Chengdu F-7NI Tactical Fighter

Nigeria, which became an important partner of China after a series of significant oil deals, placed a US$ 251 million order for 15 combat aircraft for the Federal Nigerian Air Force (FNAF) – twelve F-7NI multi-role combat aircraft and three FT-7NI trainers (see below). The deal was

The J-7G prototype
7G
A J-7G in primer finish undergoing pre-delivery tests
32
J-7G, PLAAF 12th Division/34th Regiment, Jinan-Jiaoqiang AB, Jinan Military Region
20137
J-7G, PLAAF 37th Division/109th Regiment, Kuerle AB, Lanzhou Military Region
50586

signed by the National Aero Technology Import and Export Corp.

Chengdu F-7 IIN Tactical Fighter

Another simplified version of the F-7M fitted with Chinese avionics was supplied to Zimbabwe, which ordered 22 aircraft. The Zimbabwean version represented a curious cross-breed of the F-7B and the F-7M, combining the low-mounted pitot and narrow communications radio aerial of the former with the four wing hardpoints of the latter. These fighters received the rather illogical designation F-7 IIN (this designation is not confirmed). The aircraft reportedly had the JL-7A radar.

Chengdu J-7 Target Drone Conversion

Many early-model J-7s (mainly J-7 I fighters) approaching the limit of their service life were converted to remote-controlled target drones. Such aircraft were readily identifiable by the absence of the ejection seat, since the cockpit now accommodated part of the guidance equipment.

Two late-production J-7 I fighters with the dorsal brake parachute housing ('12701 Black'

▶ **The pilots of the 'August 1st' display team in front of one of its J-7GBs.**

via Internet

J-7GB '10 White' taxies in after landing. Note the one-piece windshield, the blade aerial tipped with an oval plate and the red anti-collision lights under the cockpit and ahead of the fin. ▼

via Internet

J-7GBs '01 White' through '05 White' were painted in different colours to advertise the 2008 Beijing Olympic Games. ▼

via Internet

and '12702 Black') were painted in a smart white/dark green/orange colour scheme and wore an unidentified badge on the tail. This was probably the badge of some PLAAF test establishment, suggesting they were the prototypes of the target drone version.

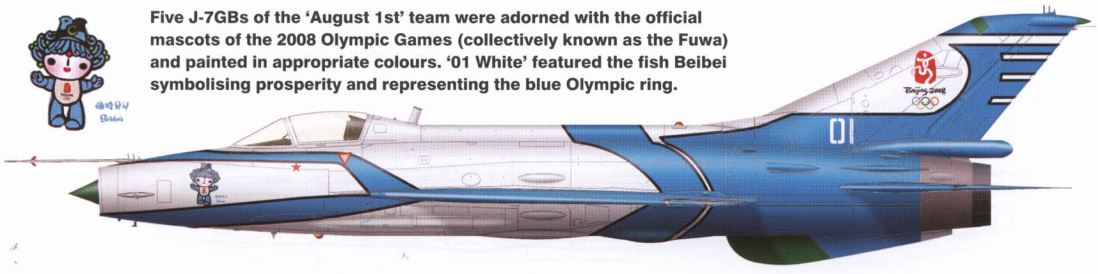
2. Two-seat trainer versions

Guizhou JJ-7 Combat Trainer

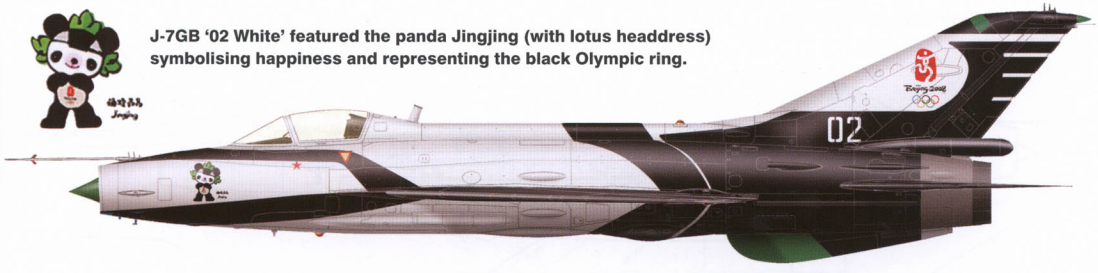
The introduction of a second-generation supersonic fighter into PLAAF service created the need for a conversion trainer offering comparable performance. Hence in 1979 the Guizhou Aircraft Factory assisted by the Guizhou Aircraft Design Institute started work on a trainer version of the J-7 broadly similar to the narrow-tailed MiG-21U (*izdeliye* 66-400). In keeping with the Chinese designation system the two-seater was designated JJ-7 (the prefix stood for *jianjiji jiaolianji* – fighter trainer).

This was not a straight copy of the *Mongol-A*; the Chinese trainer differed from its Soviet progenitor in several respects. Most noticeably, it had twin

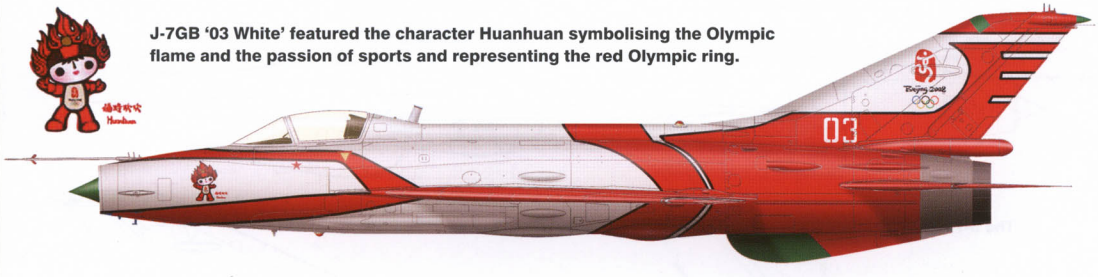
Five J-7GBs of the 'August 1st' team were adorned with the official mascots of the 2008 Olympic Games (collectively known as the Fuwa) and painted in appropriate colours. '01 White' featured the fish Beibei symbolising prosperity and representing the blue Olympic ring.



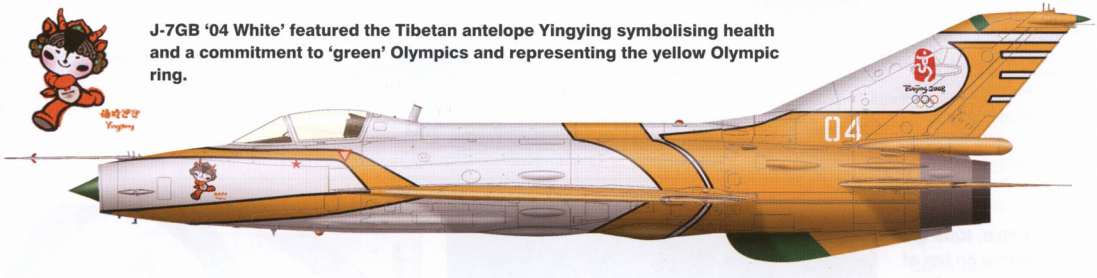
J-7GB '02 White' featured the panda Jingjing (with lotus headdress) symbolising happiness and representing the black Olympic ring.



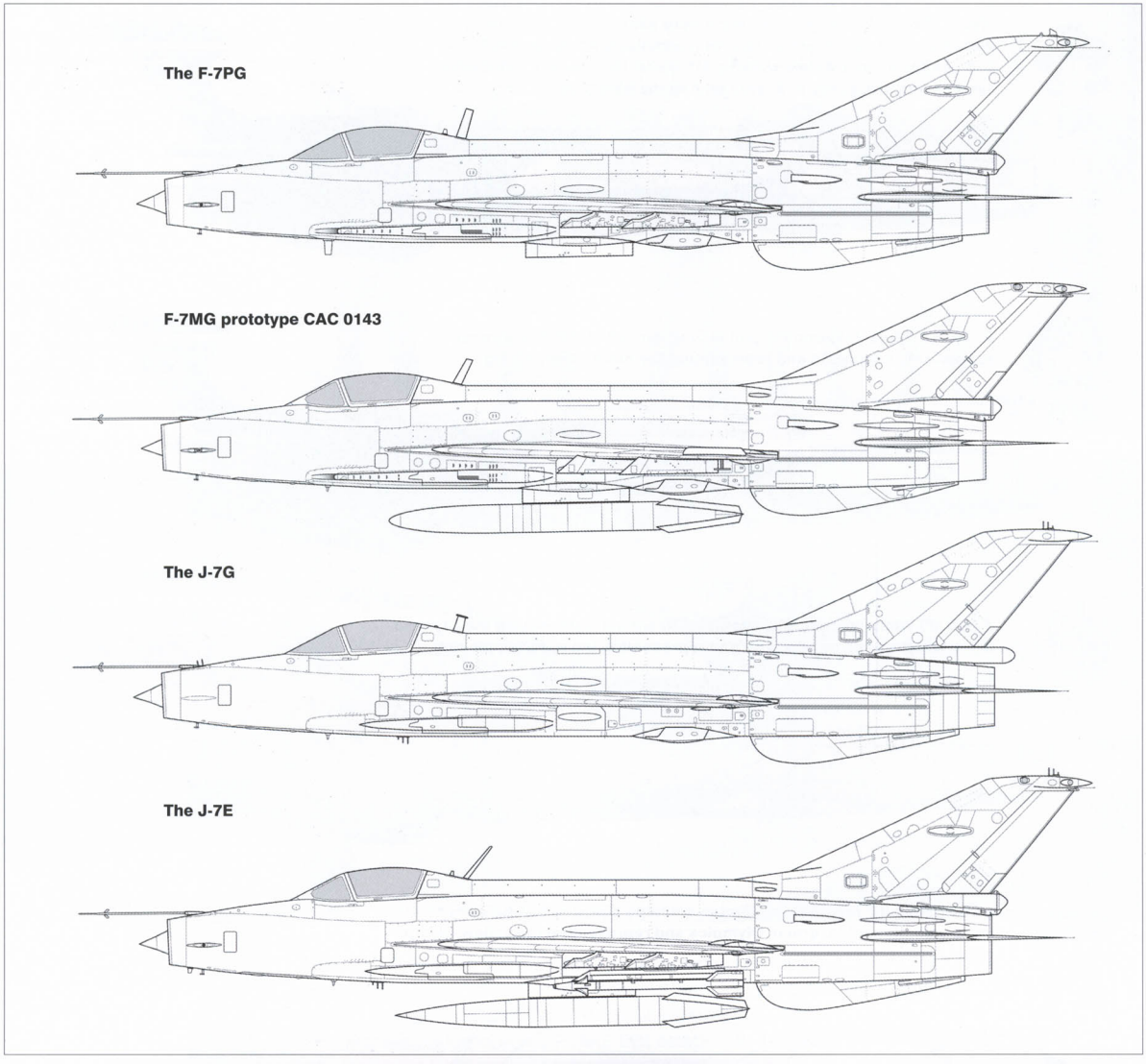
J-7GB '03 White' featured the character Huanhuan symbolising the Olympic flame and the passion of sports and representing the red Olympic ring.



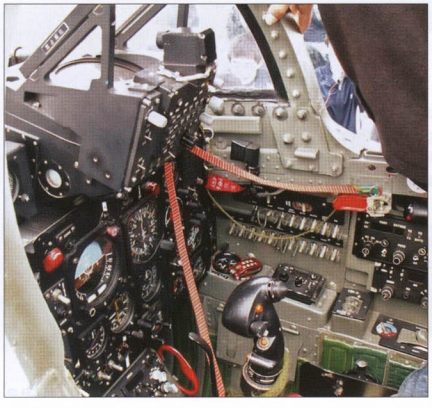
J-7GB '04 White' featured the Tibetan antelope Yingying symbolising health and a commitment to 'green' Olympics and representing the yellow Olympic ring.



J-7GB '05 White' featured the swallow Nini symbolising the endless sky and representing the green Olympic ring. Together the names of the Fuwa form the phrase *Bei Jing Huan Ying Ni* (Welcome to Beijing). All five aircraft carry the logo of the 2008 Olympic Games on the tail.



The cockpit of a J-7GB. Note the miniature video camera on top of the HUD for recording 'view from the cockpit' footage.



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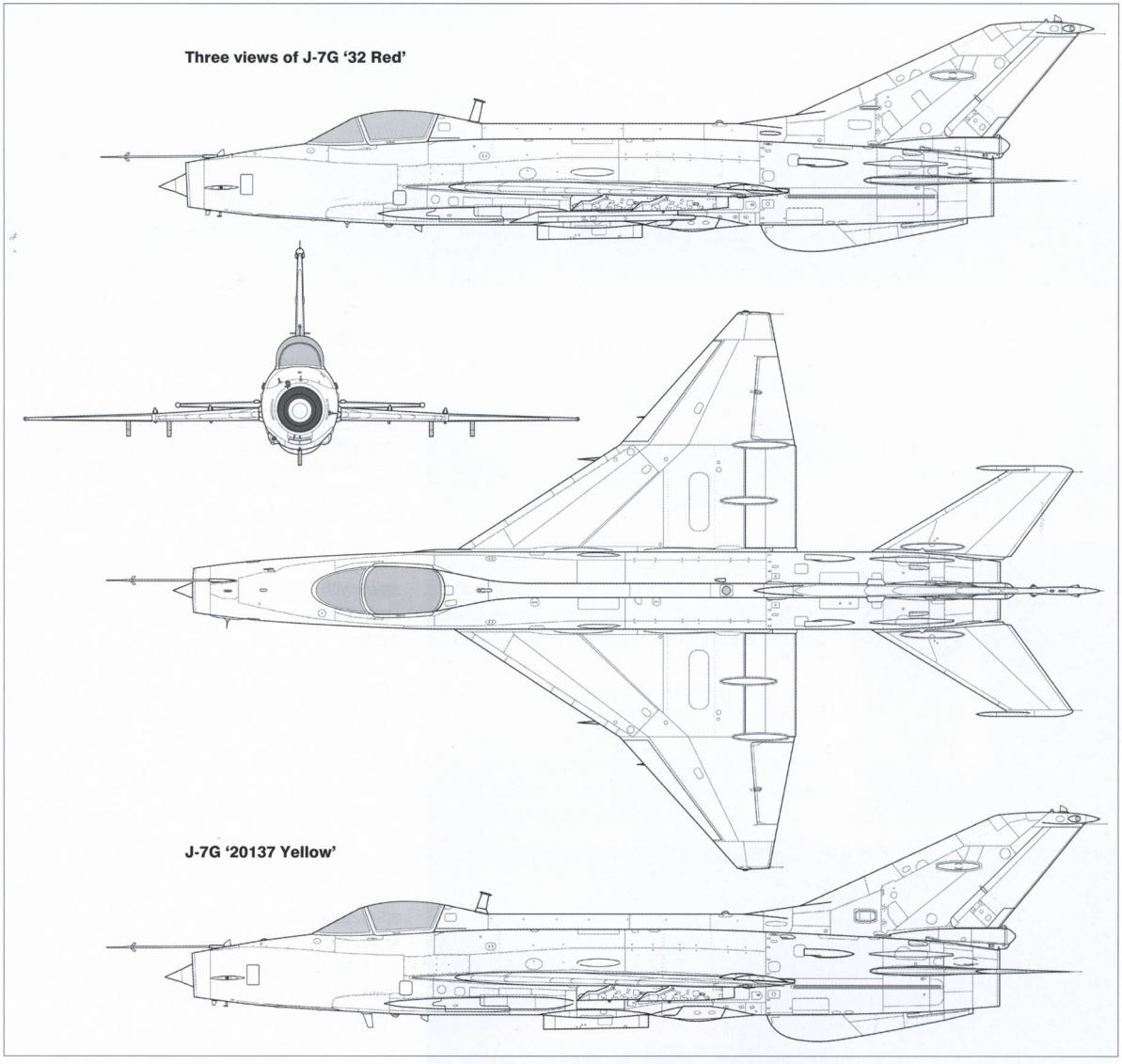

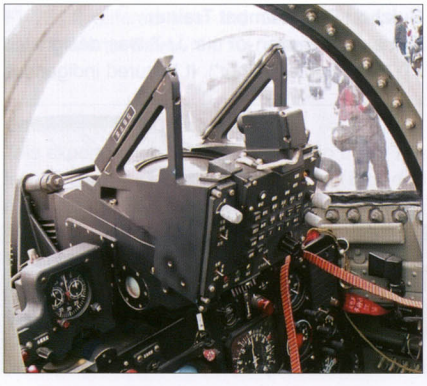

◀ **Close-ups of the same aircraft's HUD and instrument panel.**

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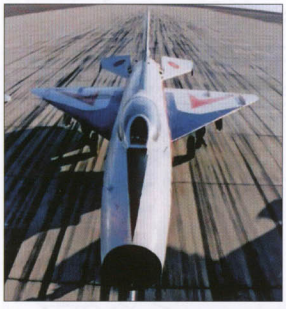
All photos via Internet

▶
Brand-new F-7N fighters awaiting delivery to the Islamic Republic of Iran Air Force.

◀
J-7 I '12701 Green' was one of several examples converted into remote-controlled target drones; note the absence of the seat.
▼◀



outward-canted ventral fins of trapezoidal planform instead of a single rounded ventral fin. Additionally, the JJ-7 featured the characteristic Chinese brake parachute fairing with a hemispherical aft end (as fitted to the late-production J-7 *sans suffixe* and subsequent versions) and the pitot boom was offset to starboard. As on the MiG-21UM/US, the canopy of the rear cockpit incorporated a forward view periscope. The cockpits featured red lighting, and a failure simulation system was provided for the instructor. Changes were made to the air intake, the fuel system (a fuel tank was installed in the fuselage spine with no change in its appearance and the 720-litre drop tank was used) and the crew escape system.

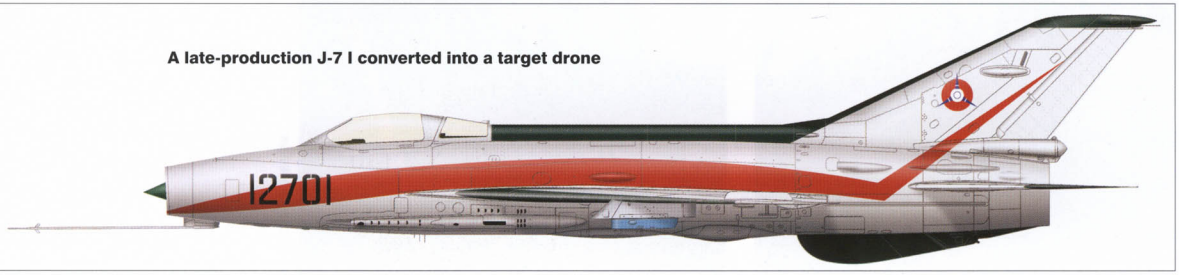
Prototype construction began in October 1982, even before the design effort was fully completed in 1983. Low-rate initial production also began in 1983. Static tests were completed in May 1985 and the first prototype took to the air on 5th July that year with Yan Xiufu at the controls. In the first flight tests, the JJ-7's cockpit was too hot due to problems in the air conditioning system. This problem, however, was eventually solved. At least six prototypes were probably involved in the test programme, including '144 Red' and '146 Red'.

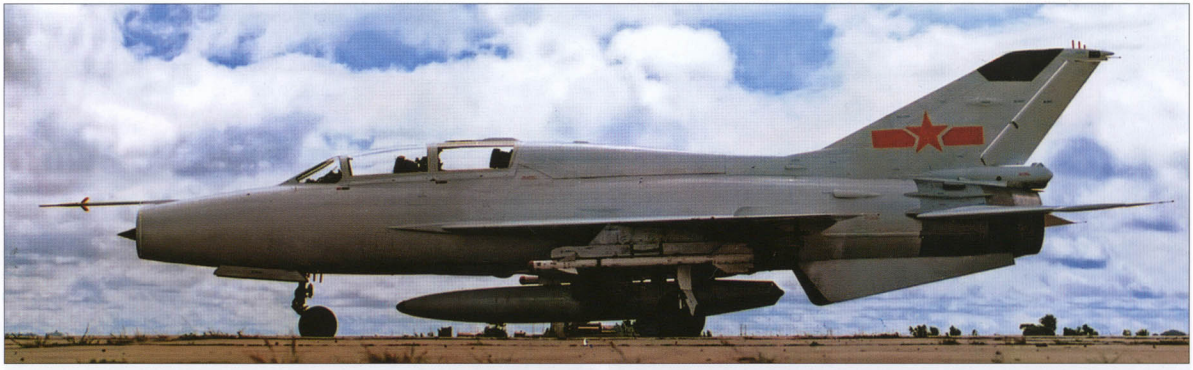
GAIGC launched full-scale production of the trainer in February 1986. Two years later, in February 1988, the JJ-7 received its type certificate.

Guizhou FT-7 Combat Trainer

The export version of the JJ-7 was designated FT-7 (for 'fighter trainer'). It featured indigenous

A late-production J-7 I converted into a target drone





All photos via Internet

Type 2 ejection seats replacing the Chinese copy of the original Soviet seats and the equipment could be configured to meet the customer's needs. The FT-7 was supplied to the air forces of Bangladesh (four aircraft), Myanmar (six), Zimbabwe (two) and Sri Lanka (one).

Guizhou JJ-7 I Combat Trainer
This was a domestic version of the JJ-7 fitted with Type 2 ejection seats. Very few were built before production switched to the JJ-7 II.

Guizhou FT-7A Combat Trainer
This was a conversion package offered to MiG-21U trainer operators, such as Egypt, to replace the original Soviet ejection seats with Chinese Type 2 seats.

Guizhou JJ-7 II Combat Trainer
The JJ-7 II was an upgraded version of the JJ-7 I featuring Rockwell Collins avionics that became standard for late J-7 models. Its recognition features were apparently the lack of a periscope in the rear cockpit and a blade aerial mounted on the fuselage spine.

Guizhou FT-7B Combat Trainer
The export version of the JJ-7 II was designated FT-7B. It differed from the earlier versions in having Martin-Baker Mk 10L zero-zero ejection seats.

Guizhou FT-7M Combat Trainer
This export version was equivalent to the F-7M, featuring an updated avionics suite that included a HUD in the front cockpit.

Guizhou FT-7 Demonstrator
A single unserialled FT-7 in blue/white GAIGC demonstrator colours was displayed at several international airshows, featuring a Type 23-II twin-barrel 23-mm cannon (another Chinese

▲▲
A JJ-7 shows the twin ventral fins and brake 'chute housing.
▲
JJ-7 '414 Red' is a development aircraft operated by CFTE.

▲
'414 Red' takes off on a test flight.

▲◄
'416 Red', another JJ-7 operated by CFTE, in camouflage colours.

◄
'81943 Red' is a JJ-7 (or JJ-7 II?) operated by the 4th Naval Division/10th Regiment. Note the lack of the forward vision persicope in the rear cockpit.

All photos via Internet

▲▲
JJ-7 trainers in the final assembly shop at Guizhou.

◄
A JJ-7 of the PLAAF's 25th Division.

White-painted JJ-7 '71263 Red' is operated by the FTTC.
▼

The display in the JJ-7's rear cockpit.
▼►

A PLAAF 21st Division JJ-7 with an AoA sensor on the nose.
▼▼

version of the GSh-23L) installed under the fuselage in lieu of the usual centreline pylon. The cannon was enclosed by a boxy fairing that was quite different differed from the neat fairing seen on the J-7C/D and the stretched FT-7P/ FT-7BG (see below), suggesting that the cannon installation was detachable.

Guizhou FT-7P Combat Trainer

In 1989 GAIC began development of a special version of the FT-7 tailored to the Pakistani Air Force's requirements. By analogy with the F-7P single-seater the aircraft was designated FT-7P. This was a true combat trainer with greatly enhanced combat potential.

The FT-7P introduced significant changes. First of all, the fuselage was stretched by inserting a 610-mm (1 ft 11½ in) 'plug' aft of the rear cockpit. This permitted installation of a Type 23-II cannon with 186 rounds under the fuselage; the centreline pylon was located aft of the cannon fairing. Secondly, the number of wing pylons was doubled to four. Thirdly, the internal fuel capacity was increased to 2,800 litres (616 Imp gal), extending the trainer's effective range by 25%; part of the extra fuel was housed in the recontoured fuselage spine, which was somewhat fatter than usual. Fourth, an uprated WP-7B engine was installed. Fifth, the back seat was installed 50 cm (1 ft 7⅛ in) higher to provide a measure of forward view and the periscope was deleted. Finally, the FT-7P had the same basic avionics fit as the F-7P – a FIAR Grifo 7M radar (previous Chinese two-seaters had no radar), an HK-03E HUD in the front cockpit, a digital mainframe computer, an HRA/2 radio altimeter, an APX-101 IFF transponder, a Type 2032 gun camera etc.

The FT-7P could carry up to four AAMs of various types – the AIM-9P Sidewinder, the Matra R.550 Magic, which were on the PAF inventory, or the Chinese PL-2, as well as FFAR pods and US Mk 82 450-kg (992-lb) free-fall bombs. The centreline pylon and the outer wing pylons were 'wet', permitting carriage of three drop tanks. Thus the FT-7P was fully combat capable.

The FT-7P entered flight test in November 1990. A total of 15 was delivered to the PAF.

Guizhou JJ-7A Combat Trainer

A similar stretched, cannon-armed variant was delivered to the PLAAF as the JJ-7A; apparently it was equipped with indigenous avionics.

Guizhou FT-7PG Combat Trainer

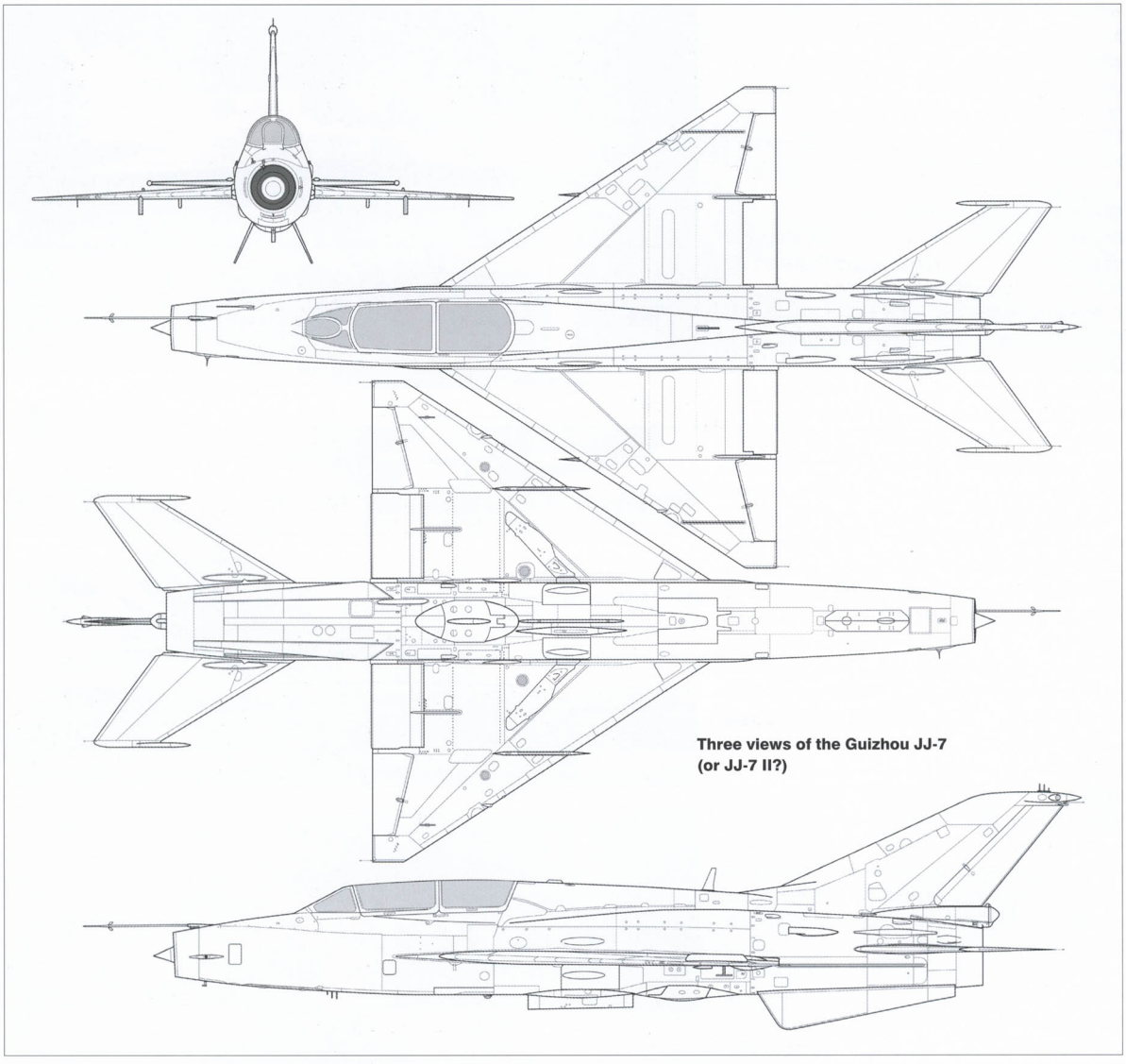
A later version developed for the PAF incorporated the systems upgrades introduced on the

All photos via Internet

▲▲▲
A model of the FT-7 having a deeper-than-usual canopy.

◀▲▲
An FT-7 demonstrator fitted with a Type 23-2 cannon.

▲
An FT-7 in a different demonstrator colour scheme.



Three views of the Guizhou JJ-7 (or JJ-7 II?)

F-7PG and was thus designated FT-7PG. Unlike the latter, the aircraft did not have the new double-delta wings.

A model of the FT-7PG displayed at one of the Zhuhai airshows featured a wraparound windshield and what appeared to be a more voluminous cockpit canopy blending into a fatter fuselage spine – but, strangely enough, no cannon. However, such display models are notoriously inaccurate.

Guizhou FT-7BG Combat Trainer

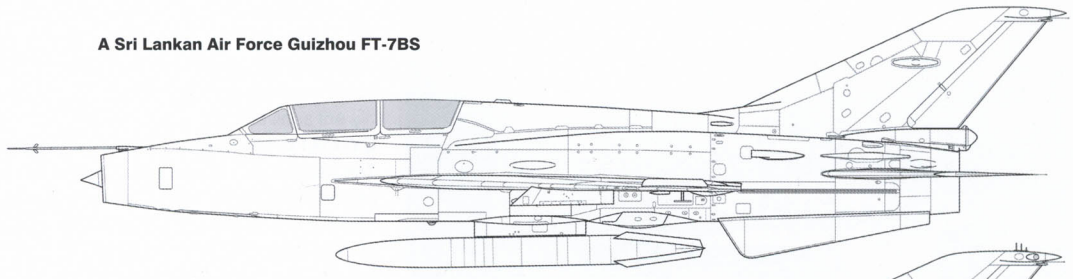
The Bangladesh Air Force also ordered a stretched, cannon-armed combat trainer version similar to the F-7BG in equipment fit, which was designated FT-7BG. Again, the aircraft had the old wing design.

Guizhou FT-7NG Trainer

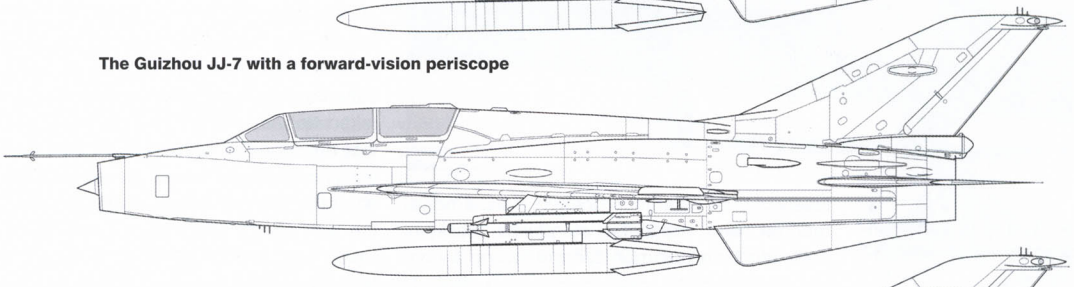
A version for the Namibian Air Force (apparently equivalent to the FT-7PG) was designated FT-7NG. Two such aircraft were delivered in November 2006.

Guizhou FT-7NI Combat Trainer

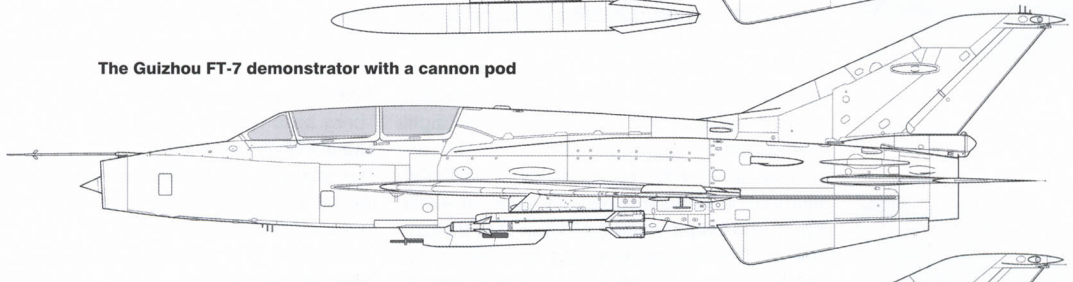
A version for the Federal Nigerian Air Force was designated FT-7NI. As mentioned earlier, three such trainers were delivered to the FNAF along



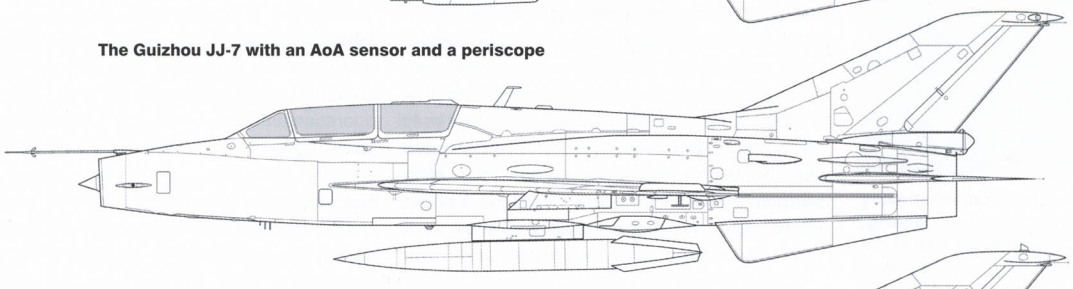
A Sri Lankan Air Force Guizhou FT-7BS



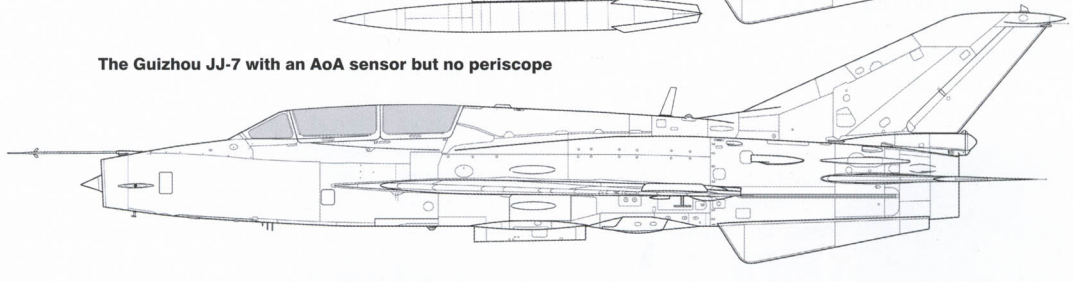
The Guizhou JJ-7 with a forward-vision periscope



The Guizhou FT-7 demonstrator with a cannon pod



The Guizhou JJ-7 with an AoA sensor and a periscope



The Guizhou JJ-7 with an AoA sensor but no periscope

with 12 single-seat F-7NI multi-role combat aircraft.

Guizhou JL-9 (FTC-2000) *Shan Ying* Combat Trainer

A radically redesigned version of the JJ-7 was developed as a lead-in fighter trainer for the Xian JH-7 (FBC-1 Flying Leopard) fighter-bomber and the Shenyang J-8D (F-8D) heavy fighter. This was to all intents and purposes a new aircraft, hence it was designated JL-9 (for *jiaolianji* – trainer) – or FTC-2000 for export; it also bore the popular name *Shan Ying* (Plateau Eagle). The new trainer combined the centre/ rear fuselage, tail unit and landing gear of the standard JJ-7 and the double-delta wings and powerplant of the J-7E/F-7MG with an all-new forward

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▲
A JJ-7 (or JJ-7 II) with a non-standard two-digit serial, '13 Yellow'.

fuselage. The latter incorporated a small ogival radome and vertically staggered cockpits enclosed by a common canopy having a one-piece windshield and individual sideways-opening portions, with a fixed section in between. The cockpits featured TY6D zero-zero ejection seats and an electronic flight instrumentation system with MFDs.

The JL-9 was powered by a WP-13F afterburning turbojet reportedly rated at 4,400 kgp (9,700 lbst) dry and 6,450 kgp (14,220 lbst) reheat. The engine breathed through semi-circular air intakes with boundary layer splitter plates and auxiliary blow-in doors (the latter were located in line with the wing leading edge). A fixed L-shaped in-flight refuelling probe similar to that of the J-8D was provided on the starboard side of the nose. There were four wing hardpoints and a centreline pylon; the inboard pylons were 'wet', not the outboard ones. PL-8 and PL-9 AAMs could be carried.

Sister ship '14 Yellow' streams its brake parachute on landing, showing the lask of the periscope in the rear cockpit and aerial ahead of the fin.
▼

The JL-9 was first revealed in model form at Airshow China 2000 at Zhuhai-Sanzao in November 2000. Two years later a full-scale mock-up converted from a JJ-7 airframe was on display at Airshow China 2002. The unmarked prototype (c/n JL90001) made its first flight on 13th December 2003.

CY-1 (LFC-16) Combat Trainer (Project)

The Beijing SuperWing Technology Research Institute (*sic*) proposed a much-modified version of the JL-9 (FTC-2000), unveiling it in model form at Airshow China 2002. Designated CY-1, the aircraft had cropped-delta wings tipped with missile rails, shoulder-mounted cropped-delta canards and a taller, reshaped vertical tail with a raked tip. Additionally, the CY-1 featured what was described as 'side-plate canards' (! – *sic*) – that is, rectangular lateral strakes beginning just aft of the canards' trailing edge and running all the way aft to merge with the horizontal tail, which had leading-edge root extensions (!). By November 2004 the designation had changed to LFC-16. GAIC was expected to build the aircraft if the decision to go ahead was taken.

The J-7 (F-7) in Detail

The following structural description applies to the J-7 II (F-7B). Details of other versions are indicated as appropriate.

Type: Single-seat supersonic tactical fighter with limited strike capability; (JJ-7/FT-7) two-seat combat trainer designed for day and night operation in visual meteorological conditions. The airframe is of all-metal construction.

Fuselage: Semi-monocoque riveted stressed-skin structure of basically circular cross-section, with a maximum diameter of 1.34 m (4 ft 4¾ in). Structurally the fuselage consists of two sections: forward and rear; the latter is

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detachable for engine maintenance/removal (the two fuselage sections are bolted together).

The *forward fuselage* incorporates an axisymmetrical circular air intake with a movable two-shock centrebody (shock cone); the latter is attached to a vertical splitter which divides the air intake into two elliptical-section air ducts passing along the fuselage sides. The J-7B introduced features from the MiG-21PF and MiG-21PFM. Higher performance is provided by the use of an uprated WP-7B turbojet, with the aid of a fully translating rather than three-position intake centrebody used by the MiG-21. The J-7C/J-7D has a larger-diameter intake and a bigger shock cone. The extreme nose accommodates the nosewheel well, with the avionics bay (accessed via a dorsal cover) above it. A pitot boom is mounted centrally under the nose on the J-7 *sans suffixe*/J-7 I/J-7 II/J-7 IIH (it can be tilted up on the ground to prevent damage). All other versions have a fixed pitot mounted on the upper side of the nose.

Further aft is the pressurised cockpit enclosed by a bubble canopy. The fixed windscreen comprises curved triangular Perspex sidelights and a quasi-elliptical optically flat windshield (which is birdproof from the J-7 IIA onwards); the F-7MG (F-7PG) and F-7G have a curved one-piece windscreen. The movable portion of the canopy with blown Perspex glazing is hinged at the rear and opened by a hydraulic ram; it can be jettisoned manually or automatically (as part of the ejection sequence) in an emergency; the aft canopy fairing blends smoothly into a shallow fuselage spine housing control runs which continues all the way to the vertical tail. The original J-7 *sans suffixe* and J-7 I have a one-piece forward-hinged canopy with an integrated bulletproof windscreen that was actuated hydraulically and acted as a slipstream shield during ejection; the fairing aft of the cockpit incorporates a small curved transparency. The J-7C/J-7D has a two-piece canopy faired into a much fatter fuselage spine; the rear portion opens manually to starboard and is provided with a faired rear view mirror.

The JJ-7 (FT-7) features tandem cockpits enclosed by a common canopy with a fixed three-piece windscreen and individual canopy sections opening manually to starboard; the rear section covering the instructor's seat incorporates a retractable forward vision periscope. On the JJ-7A and FT-7P/PG/BG the fuselage is stretched 610 mm (1 ft 11½ in) aft of the cockpits, providing room for an internal cannon and extra fuel, and the fuselage spine is recontoured.

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Two auxiliary blow-in doors are located on the forward fuselage sides just ahead of the wing/fuselage fairing, opening as required to prevent engine surge at high rpm. On single-seaters the centre portion of the forward fuselage incorporates a cannon bay on the starboard side (or on both sides in the case of the J-7 I and the F-7PG); on the JJ-7A and FT-7P/PG/BG a single cannon is located on the centreline. The centre portion of the forward fuselage also incorporates two door-type airbrakes located on the lower fuselage sides in line with the wing leading edge, the mainwheel wells (with a plumbed pylon for a drop tank in between) and the perforated rear airbrake (located ventrally on the centreline) and attachment lugs for the wing panels. The rear portion is the engine bay. The airbrakes are actuated hydraulically.

The rear fuselage is a one-piece structure fitting around the engine. It carries the tail surfaces and incorporates and the brake parachute bay located ventrally on the J-7 sans suffixe and early-production J-7 Is. Subsequent versions have a brake parachute housing at the base of the vertical tail.

Wings: Cantilever mid-wing monoplane. Most versions have cropped-delta wings similar to those of the Soviet-built MiG-21F-13, with constant 57° leading-edge sweep and 49° 6' 36" sweepback at quarter-chord, no trailing-edge sweep; anhedral 2° from roots, incidence 0°, aspect ratio 2.2, no leading-edge camber. Thickness/chord ratio approximately 5% at root, 4.2% at tip.

The wings are one-piece structures of stressed-skin construction with two primary spars and an auxiliary spar. The wing torsion box houses four integral fuel tanks. The wings have one-piece rectangular flaps terminating at approximately half-span, each with an actuator fairing on the wing upper surface at the outer end, with tapered ailerons outboard of these; there are no leading-edge devices. Each wing

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▲
An example of the stretched FT-7PG.

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▲
The cockpits of the JL-9 (FTC-2000) trainer feature two MFDs each. There is also an HUD/up-front control panel in the forward cockpit.
▼

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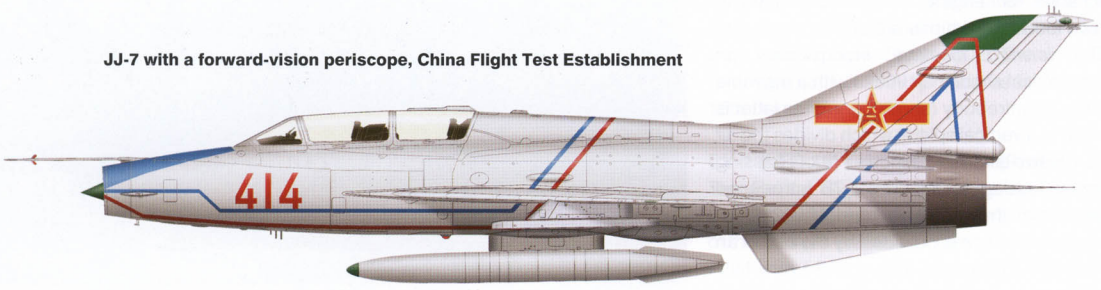
JJ-7 with a forward-vision periscope, China Flight Test Establishment

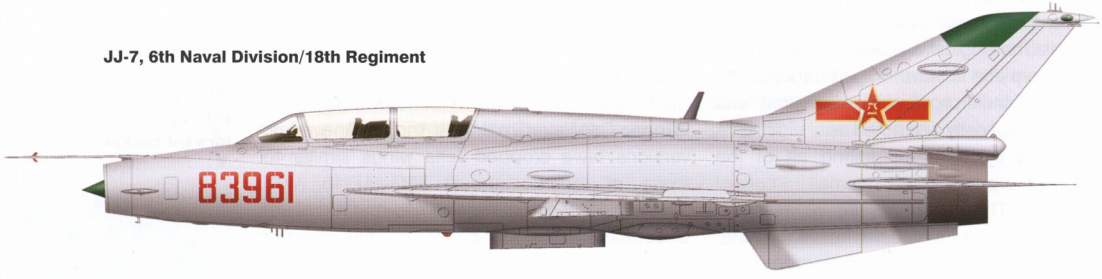


FT-7 demonstrator, Guizhou Aircraft Industry Corp.

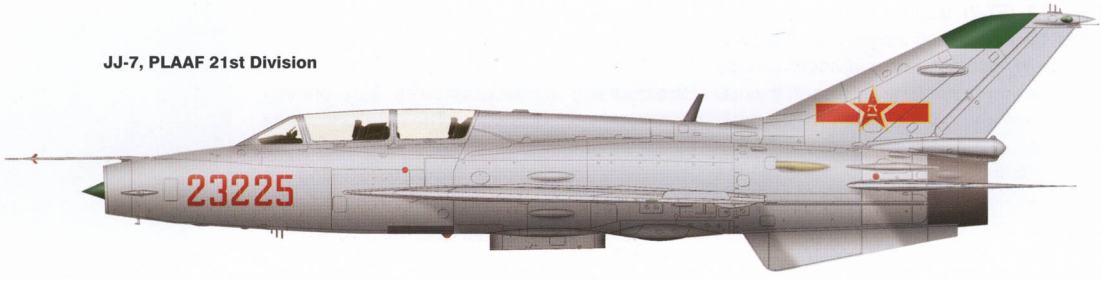
FT-7

FT-7 demonstrator with Type 23-I cannon pod

JJ-7, 6th Naval Division/18th Regiment



JJ-7, PLAAF 21st Division



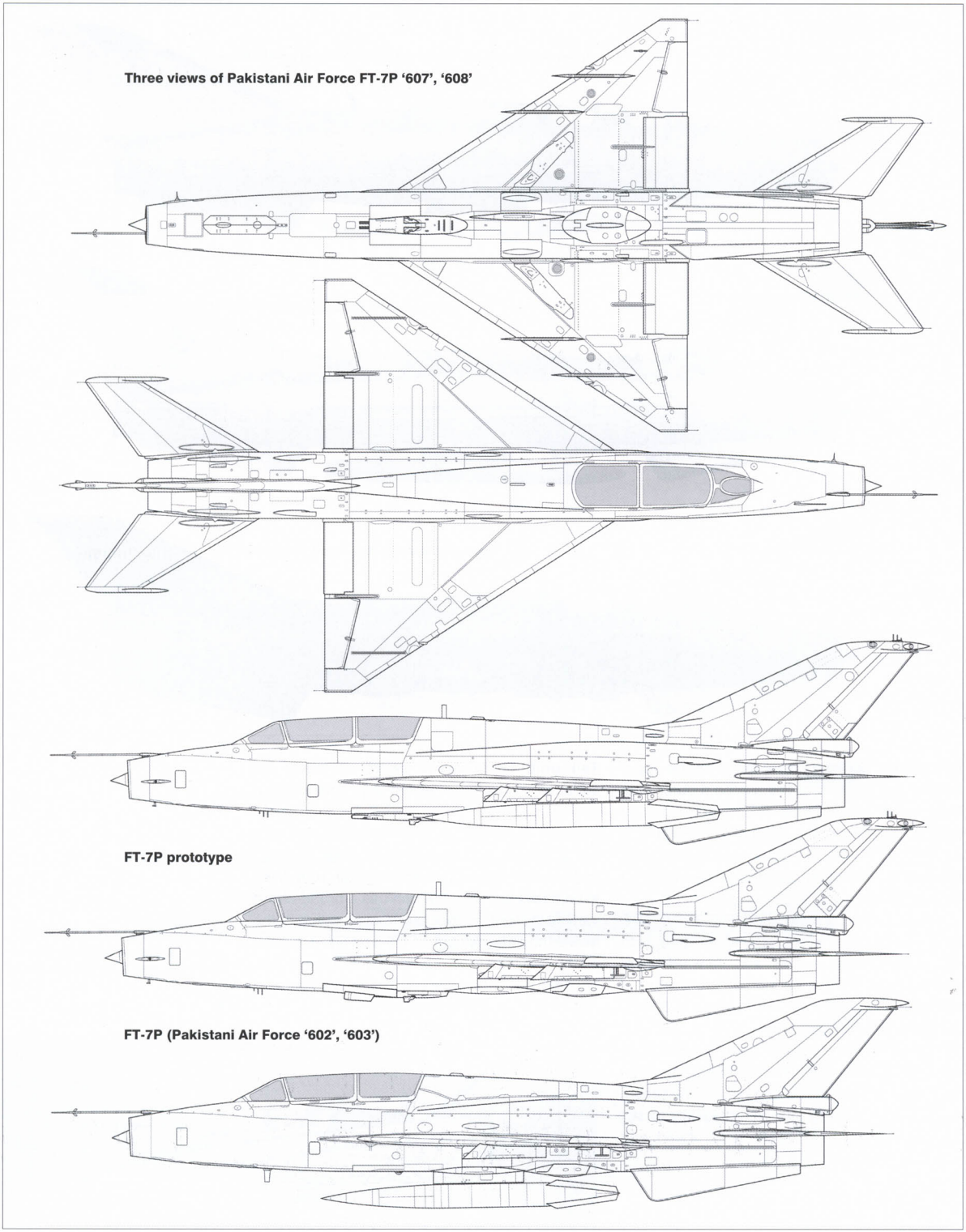
has a single boundary layer fence on the upper surface just inboard of the aileron's outer end. The wings incorporate two hardpoints for pylons, except on the F-7M/F-7P/F-7MB and JJ-7A/FT-7P/FT-7PG/FT-7BG, which have four hardpoints, the outer pair being plumbed for drop tanks.

The J-7E/J-7G and F-7MG/F-7PG/F-7BG have double-delta wings of greater span, with 42° leading-edge sweep and forward-swept trailing edge on the outer portions (outboard of the flaps); the aspect ratio is increased to 2.8 and sweepback at quarter-chord is thus reduced. The outer portions feature leading-edge flaps and no boundary layer fences; the trailing-edge flaps have two actuator fairings each. The setting of the LE flaps is adjusted automatically to suit the current angle of attack, flight speed and altitude. Again, the double-delta wings incorporate four hardpoints.

Tail unit: Conventional swept cantilever tail surfaces of riveted stressed-skin construction, similar to those of the MiG-21F-13 on most versions. The *vertical tail* comprises a one-piece fin, a rudder and a ventral fin. The fin is of trapezoidal planform with a small root fillet, except for the F-7C/D, which has a broad-chord vertical tail with no root fillet similar to that of the MiG-21MF. The fin carries IFF and RWR aerials; on the F-7C/D it incorporates a glassfibre fin cap housing the radio antenna. The mass-balanced rudder is a single-spar structure.

A model of the JL-9 (FTC-2000) trainer shown at Airshow China 2002; note the in-flight refuelling probe.
▼

Sergey Scrynnikov



Three views of Pakistani Air Force FT-7P '607', '608'

FT-7P prototype

FT-7P (Pakistani Air Force '602', '603')

Single-seat versions have a single curved ventral fin with a dielectric front portion, as on the MiG-21. The JJ-7 (FT-7) has twin outward-canted ventral fins of trapezoidal planform.

The mid-set *horizontal tail* consists of all-movable slab stabilisers (stabilators) of trapezoidal planform. The stabilators feature anti-flutter weights projecting beyond the leading edge at the tips.

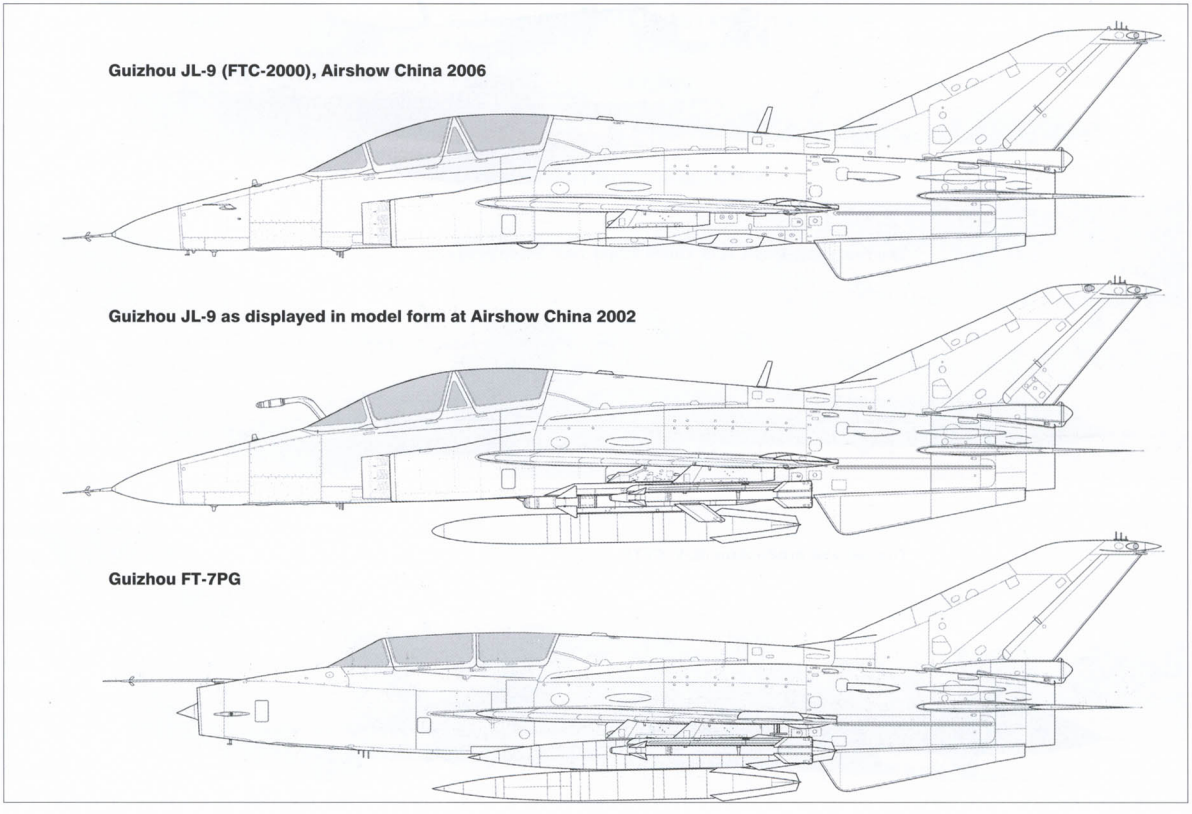
Landing gear: Hydraulically retractable tricycle type, with single wheel on each unit. Nose unit retracts forward, main units inward, the wheels turning around oleos to stow almost vertically alongside inlet duct. The nosewheel has a 500 x 180 mm (19.68 x 7.08 in) tyre and an LS-15 dual-action brake; the mainwheels are fitted with 600 x 200 mm (23.62 x 7.87 in) tyres and LS-16 disc brakes. Tyre pressure 7.00 bars (102 psi) for the

via Internet

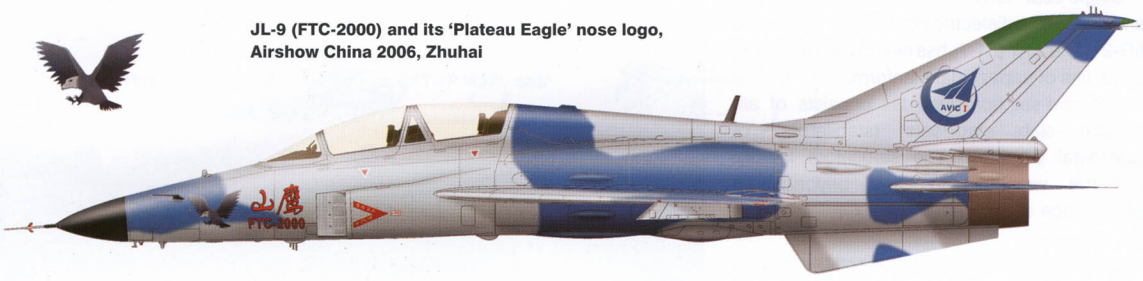
►▲ **The first prototype JL-9 (c/n JL90001). The radome is under wraps in this view**

Xinhua

► **This in-flight shot illustrates the JL-9's double-delta wing planform.**

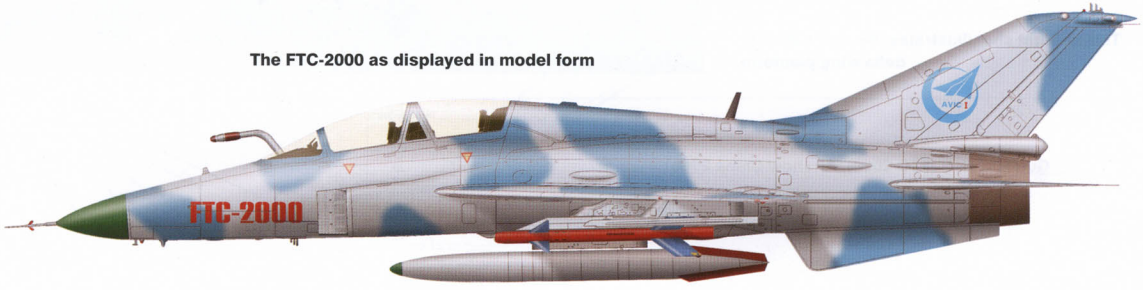


JL-9 (FTC-2000) and its 'Plateau Eagle' nose logo, Airshow China 2006, Zhuhai



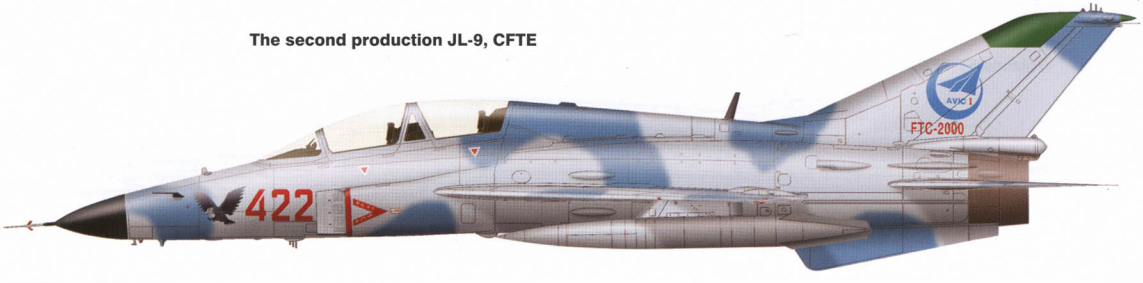
The FTC-2000 as displayed in model form at Airshow China 2002

The FTC-2000 as displayed in model form



The first production JL-9, China Flight Test Establishment

The second production JL-9, CFTE



Xinhua

▲
The unpainted JL-9 (FTC-2000) prototype taxies during initial flight tests.

nosewheel and 11.50 bars (167 psi) for the mainwheels. The nosewheel is steerable through ±47°; minimum ground turning radius 7.04 m (23 ft 1¼ in).

The nosewheel well is closed by twin lateral doors, the mainwheel wells by main doors hinged to the fuselage and two-segment doors attached to the oleo legs. All doors remain open when the gear is down. The main gear doors and the upper fuselage sides in the area of the mainwheel wells are bulged to accommodate the wheels

A brake parachute is provided to reduce the landing run. On the J-7 *sans suffixe* and early J-7 Is it is housed in a special bay on the rear fuselage underside. On later versions the brake parachute is stowed in a special housing with an upward-hinged cover at the base of the vertical tail.

Powerplant: One LMC (Liyang) WP-7B axial-flow afterburning turbojet rated at 4,400 kgp (9,700 lbst) at full military power and 6,100 kgp (13,450 lbst) in full afterburner. The J-7 *sans suffixe* and J-7 I have a WP-7 engine delivering 3,835 kgp (8,460 lbst) dry and 5,100 kgp (11,240 lbst) reheat. The J-7 IIA and F-7M are powered by a WP-7BM engine, which has the same thrust rating as the B model but is lighter, more reliable and has an improved starting system.

The J-7C and J-7D are powered by a WP-13 or WP-13F1 afterburning turbojet rated at 4,100 kgp (9,040 lbst) dry and 6,600 kg (14,550 lbst) reheat. The J-7E/J-7G and F-7MG/F-7PG/F-7BG have a WP-13F engine with the same afterburner rating but a dry thrust increased to 4,500 kgp (9,920 lbst). Some sources quote the WP-13F's thrust as 4,400 kgp and 6,500 kgp (14,330 lbst) respectively.

Control system: Conventional mechanical flight control system with push-pull rods, cranks and levers; a Beijing Aeronautical Instruments Factory KJ-11 two-channel autopilot providing autostabilisation in pitch and roll is fitted. Roll control is by means of hydraulically boosted inset ailerons. The J-7E/J-7G and F-7MG/F-7PG/F-7BG have leading-edge/trailing-edge manoeuvring flaps. Directional control is provided by a mass-balanced hydraulically boosted rudder. Pitch control is provided by trimmable hydraulically boosted slab stabilisers (stabilators).

Fuel system: Internal fuel is carried in six flexible tanks in the fuselage and two integral tanks in the wings. Total internal fuel capacity 2,385 litres (524.5 Imp gal); total internal fuel load 2,080

The first ('421 Red') and second production examples of the JL-9 seen during trials at CFTE.
▼

www.stormpages.com

www.stormpages.com

www.DefenceTalk.com

▶ **This front view of JL-9 '421 Red' taxiing out for a test sortie shows the large air intakes and their splitter plates.**

(4,585 lb). The J-7E/J-7G and F-7MG/ F-7PG/F-7BG have larger wing tanks increasing the internal fuel capacity to 4,775 litres (1,050 Imp gal) and the internal fuel load to 4,165 kg (9,180 lb). The JJ-7 (FT-7) and the FT-7P have a fuel load of 1,891 kg (4,169 lb) and 2,170 kg (4,780 lb) respectively. Single-point refuelling is provided.

All versions have provisions for carrying a 480- or 720-litre (105.6 or 158.4 Imp gal) centreline drop tank; some sources quote the capacity of the two models as 500 and 800 litres (110 and 176 Imp gal) respectively. The F-7M/ F-7P and J-7E/J-7G can carry 480-litre drop tanks on the outboard wing pylons. Maximum internal/ external fuel capacity 4,185 litres (920.5 Imp gallons).

Oxygen system: Jianghuai YX-3 oxygen system.

Avionics and equipment: The avionics configuration varies on different variants.

Targeting equipment: SM-3A optical sight (J-7); AFS-3A lead-computing sight with Type 222 ranging radar input (J-7 II); GEC-Marconi Type 956 HUD/weapon-aiming computer system (HUDWAC). The HUDWAC provides pilot with displays for instrument flying, with air-to-air and air-to-ground weapon aiming symbols integrated with flight-instrument symbology. It receives input from the GEC-Marconi Type 226 Skyranger 7M ranging radar (F-7M), FIAR Grifo-7 pulse-Doppler fire control radar (F-7P), GEC-Marconi Super Skyranger radar (F-7MG) or FIAR Grifo MG fire control radar (F-7PG). JL-7 pulse-Doppler fire control radar on J-7C/D. The radar antenna is housed in the air intake centrebody. A licence-built Russian helmet-mounted sight (HMS) is integrated on the J-7G for aiming PL-9 AAMs.

Flight avionics: (F-7M) WL-7 radio compass, Type 0101 HR A/2 low-altitude radio altimeter, LTC-2 horizon gyro, XS-6 marker beacon receiver, VOR, DME, ILS and Tacan.

IFF system: Type 602 IFF transponder (Chinese copy of SRO-2M Odd Rods) with aerials on the nose and at the top of the fin.

ESM/SCM equipment: KG-8602 RWR with aerials on wings and tail, interfaced with KG-8605 built-in active jammer (both developed by the South-West China Research Institute of Electronic Equipment) and China National Import and Export Corporation GT-1 chaff/flare dispenser on F-7M. Chinese LJ-2 RWR and GT-4 ECM jammer on J-7C/D.

Data recording equipment: FJ-1 flight data recorder on J-7C/D.

Armament: The built-in armament of the J-7 *sans suffixe*, J-7E/F-7PG and J-7G comprises a single 30-mm (1.18 calibre) Type 30-1 cannon with 60 rounds low on the starboard side of the forward fuselage. The J-7 I, J-7 II, J-7 IIA, F-7BS, F-7M/MB, F-7N, F-7P and F-7PG have two such cannons installed symmetrically, with 60 rpg. The J-7C/J-7D has a 23-mm (.90 calibre) Type 23-III twin-barrel cannon with 200 rounds installed on the fuselage centreline, while the JJ-7A and FT-7P/FT-7PG/FT-7BG have a similarly installed Type 23-II cannon with 186 rounds. The improved FT-7P carries a twin-30mm Type 30-1 cannon with 60 rounds per gun in the lower sides of the fuselage.

The J-7 *sans suffixe*, J-7 I, J-7 II, J-7 IIA, J-7 IIH and F-7BS have two wing pylons rated at 500 kg (1,102 lb) each; so do early versions of the JJ-7/FT-7. The F-7M/MB, F-7N, F-7P, J-7C/D,

J-7E/F-7PG/F-7MG and J-7G have two identically rated hardpoints under each wing; so do the JJ-7A/FT-7P/FT-7PG/FT-7BG.

The J-7 sans suffixe, J-7 I and J-7 II can carry two PL-2 or PL-2A IR-homing short-range AAMs. The F-7B and J-7 IIA introduced the ability to launch Matra R.550 Magic (aka PL-7) short-range AAMs. The F-7M can be armed with four PL-2, PL-2A, PL-5B or PL-7 IR-homing missiles; the F-7P and F-7PG are armed with AIM-9P Sidewinder AAMs, while the weapons range of the J-9G and F-7MG also includes PL-9 AAMs. The basic JJ-7 can carry two PL-5B missiles, while the FT-7P/FT-7PG is armed with Sidewinders.

Air-to-ground weapons include two or four 50-, 150- or 250-kg free-fall bombs, or two 500-kg bombs. Additionally, two or four Qingan HF-7C 18-tube FFAR pods loaded with 57-mm (2.24-in) Type 57-2 rockets, or seven-tube FFAR pods loaded with 90 mm (3.54-in) rockets can be fitted. The J-7C/D does not carry the 18-tube variety, using Qingan HF-16B 12-round pods for Type 57-2 FFARs instead; it can also carry ten 100-kg bombs.

The J-7 IIH is adapted for maritime strike and able to carry C-802 anti-shipping missiles.

Rescue system: The J-7 II is equipped with a CAC Type 2 cartridge-fired zero-height/low-speed ejection seat permitting safe ejection at low altitudes within a speed range of 130-850 km/h (81-527 mph). The J-7 *sans suffixe* and J-7 I have an ejection system based on the Mikoyan SK ejection seat. The J-7 IIA has a CAC zero-zero ejection seat. Domestic versions of the JJ-7 from the JJ-7 I onwards are equipped with CAC Type 2 ejection seats. The F-7P/F-7MP, F-7MG/F-7PG and FT-7P/FT-7PG are equipped with Martin-Baker Mk 10L zero-zero ejection seats. The J-7C/J-7D has a CAC HTY-4 zero-zero ejection seat.

Specifications of the J-7 (F-7) family

	J-7 II	F-7M	J-7E	F-7PG	J-7C	JJ-7	FT-7P
Length overall (less pitot)	13.945 m (45 ft 9 in)	13.945 m (45 ft 9 in)	13.46 m (44 ft 2 in)	13.46 m (44 ft 2 in)	14.7 m (48 ft 2¾ in)	n.a.	n.a.
Length overall (incl. pitot)	14.885 m (48 ft 10 in)	14.885 m (48 ft 10 in)	14.885 m (48 ft 10 in)	14.885 m (48 ft 10 in)	n.a.	14.87 m (48 ft 9¼ in)	15.47 m (50 ft 9 in)
Fuselage length	12.175 m (39 ft 11½ in)	12.175 m (39 ft 11½ in)	12.175 m (39 ft 11½ in)	12.175 m (39 ft 11½ in)	n.a.	12.175 m (39 ft 11½ in)	n.a.
Height on ground	4.105 m (13 ft 5½ in)	4.105 m (13 ft 5½ in)	4.125 m (13 ft 6 in)	4.125 m (13 ft 6 in)	n.a.	4.105 m (13 ft 5½ in)	n.a.
Wing span	7.15m (23 ft 5¾ in)	7.15m (23 ft 5¾ in)	8.32 m (27 ft 3½ in)	8.32 m (27 ft 3½ in)	7.15m (23 ft 5¾ in)	7.15m (23 ft 5¾ in)	7.15m (23 ft 5¾ in)
Wing chord at root	5.51 m (18 ft 0¾ in)	5.51 m (18 ft 0¾ in)	5.51 m (18 ft 0¾ in)	5.51 m (18 ft 0¾ in)	5.51 m (18 ft 0¾ in)	5.51 m (18 ft 0¾ in)	5.51 m (18 ft 0¾ in)
Wing chord at tip	0.46 m (1 ft 6¼ in)	0.46 m (1 ft 6¼ in)	n.a. n.a.	n.a. n.a.	0.46 m (1 ft 6¼ in)	0.46 m (1 ft 6¼ in)	0.46 m (1 ft 6¼ in)
Wing area, m² (sq ft)	23.00 (247.6)	23.00 (247.6)	24.88 (267.8)	24.88 (267.8)	23.00 (247.6)	23.00 (247.6)	23.00 (247.6)
Aileron area, m² (sq ft)	1.18 (12.70)	1.18 (12.70)	n.a.	n.a.	1.18 (12.70)	1.18 (12.70)	1.18 (12.70)
TE flap area, m² (sq ft)	1.87 (20.13)	1.87 (20.13)	1.87 (20.13)	1.87 (20.13)	1.87 (20.13)	1.87 (20.13)	1.87 (20.13)
Tailplane span	3.74 m (12 ft 3¼ in)	3.74 m (12 ft 3¼ in)	3.74 m (12 ft 3¼ in)	3.74 m (12 ft 3¼ in)	3.74 m (12 ft 3¼ in)	3.74 m (12 ft 3¼ in)	3.74 m (12 ft 3¼ in)
Fin area, m² (sq ft)	3.48 (37.46)	3.48 (37.46)	3.48 (37.46)	3.48 (37.46)	3.48 (37.46)	3.48 (37.46)	3.48 (37.46)
Rudder area, m² (sq ft)	0.97 (10.44)	0.97 (10.44)	0.97 (10.44)	0.97 (10.44)	0.97 (10.44)	0.97 (10.44)	0.97 (10.44)
Horizontal tail area, m² (sq ft)	3.94 (42.41)	3.94 (42.41)	3.94 (42.41)	3.94 (42.41)	3.94 (42.41)	3.94 (42.41)	3.94 (42.41)
Landing gear track	2.69 m (8 ft 10 in)	2.69 m (8 ft 10 in)	2.69 m (8 ft 10 in)	2.69 m (8 ft 10 in)	2.69 m (8 ft 10 in)	2.69 m (8 ft 10 in)	2.69 m (8 ft 10 in)
Landing gear wheelbase	4.805 m (15 ft 9¼ in)	4.805 m (15 ft 9¼ in)	4.805 m (15 ft 9¼ in)	4.805 m (15 ft 9¼ in)	4.805 m (15 ft 9¼ in)	4.805 m (15 ft 9¼ in)	4.805 m (15 ft 9¼ in)
Empty weight, kg (lb)	5,275 (11,629)	5,275 (11,629)	5,292 (11,667)	5,292 (11,667)	n.a.	5,519 (12,167)	5,300 (11,684)
Normal TOW, kg (lb) †	7,531 (16,603)	7,531 (16,603) *	7,540 (16,623)	7,540 (16,623)	8,150(17,967)	n.a.	7,590 (16,733)
Maximum TOW, kg (lb)	n.a.	n.a.	9,100 (20,062)	9,100 (20,062)		8,555 (18,860)	9,550 (21,050)

Maximum ordnance load, kg (lb)	n.a.	n.a.	2,000 (4,410)	2,000 (4,410)	n.a.	1,187 (2,617)	n.a.
Wing loading at normal TOW, kg/m² (lb/sq ft)	n.a.	327.4 (67.06) *	n.a.	n.a.	n.a.	n.a.	n.a.
Max wing loading, kg/m² (lb/sq ft)	n.a.	n.a.	379 (77.8)	365.8 (74.91)	n.a.	372.0 (76.18)	415.2 (85.04)
Power loading at normal TOW, kg/kgp (lb/lbst)	n.a.	1.23 *	n.a.	1.38	n.a.	1.4	1.56
Never-exceed speed above 12,500 m (41,010 ft), km/h (mph)	n.a.	2,495 (1,550) Mach 2.35				2,495 (1,550) Mach 2.35	
Max level speed between 12,500 and 18,500 m (41,010-60,700 ft), km/h (mph)	n.a.	2,175 (1,350) Mach 2.05	2,175 (1,350) Mach 2.05	n.a. Mach 2.0	2,300 (1,428)	2,175 (1,350) Mach 2.05	n.a.
Stalling speed (flaps deployed), km/h (mph)	n.a.	n.a.	n.a.	210 (131)	n.a.	250 (156)	n.a.
Touchdown speed, km/h (mph)	n.a.	300-320 (186-199)	n.a.	n.a.	n.a.	305-325 (189-202)	n.a.
Max rate of climb at sea level, m/sec (ft/min)	n.a.	180 (35,435)	n.a.	195 (38,386)	150 (29,520)	155 (30,510)	n.a.
Acceleration from Mach 0.9 to Mach 1.2 at 5,000 m (16,400 ft), sec	n.a.	35	n.a.	n.a.	n.a.	n.a.	n.a.
Max sustained turn rate, deg/sec:							
at sea level at Mach 0.7	n.a.	14.7	n.a.	n.a.	n.a.	n.a.	n.a.
at 1,000 m (3,280 ft)	n.a.	n.a.	n.a.	16	n.a.	n.a.	n.a.
at 5,000 m (16,400 ft) and Mach 0.8	n.a.	9.5	n.a.	11	n.a.	n.a.	n.a.
at 8,000 m (26,250 ft)		n.a.		8	n.a.	n.a.	n.a.
Service ceiling, m (ft)	18,200 (59,720)	18,200 (59,720)	18,800 (61,700)	17,500 (57,420)	18,000 (59,055)	17,300 (56,760)	n.a.
Absolute ceiling, m (ft)	n.a.	18,700 (61,360)	n.a.	18,000 (59,060)	n.a.	17,700 (58,080)	n.a.
Take-off run, m (ft)	700 (2,300)	700-950 (2,300-3,120)	600 (1,970)	600 (1,970)	800 (2,620)	827 (2,715)	n.a.
Landing run with brake parachute, m (ft)	600 (1,970)	600-900 (1,970-2,955)	600 (1,970)	600 (1,970)	500 (1,640)	1,060 (3,480)	n.a.
Range w. two PL-7 AAMs and three 500 litre drop tanks, km (miles)	n.a.	1,740 (1,080)	n.a.	n.a.	n.a.	n.a.	n.a.
Ferry range w. two 500-litre drop tanks and one 800-litre drop tank/no AAMs, km (miles)	n.a.	2,230 (1,385)	2,200 (1,380)	2,200 (1,380)	1,900 (1,180)	1,010 (627) **	n.a.
Combat radius, km (miles)	n.a.	n.a.	850 (528) ‡	850 (528) ‡ 550 (342) §	n.a.	n.a.	n.a.
G limit (with 2 missiles)	+8	+8	+8	+8/–3	+8	+7	n.a.

* F-7P

† With two PL-2 or PL-7 AAMs

‡ Air superiority mission (hi-hi-hi), with three 720-litre drop tanks and two AAMs or other light external stores [J-7E] with two AIM-9P AAMs and three 500-litre drop tanks, incl 5 min combat with afterburner [F-7PG]

§ Ground attack mission (lo-lo-hi) with two Mk 82 bombs and two 500-litre drop tanks

** With one 720-litre drop tank

The performance of the F-7M is indicated at normal TOW with two PL-2 or PL-7 AAMs

PART EIGHT

IN SOVIET AIR FORCE SERVICE

The Soviet Air Force had a tradition: initial production fighters were invariably fielded with an air regiment stationed near Moscow for pilots to learn the idiosyncrasies of new types as soon as possible. There were three such regiments – the 32nd, 234th and 274th Guards Fighter Regiments (GvIAP – *Gvar**dey**skiy istre**bit**el'nyy **a**via**polk***) – in the 9th Fighter Division (IAD – *istre**bit**el'naya **a**viadi**vee**ziya*) garrisoned at Kubinka airbase about 60 km (37 miles) west of Moscow. The 234th GvIAP was the Air Force's 'showcase' regiment intended for special displays, with the other two just participating in demonstrations or air parades.

The 32nd GvIAP was among the first Soviet Air Force regiments to be fielded with the then-advanced MiG-21F fighter in 1960. Its personnel converted to the new aircraft at MMZ No. 30 in Moscow and at GK NII VVS. Test pilots Gheorgiy K. Mosolov and Konstantin K. Kokkinaki would come repeatedly to Kubinka AFB at that time. Ground crews converted mostly at Aircraft Plant No. 21 in the city of Gor'kiy. On 5th March 1960 the regiment took delivery of the first consignment of MiG-21Fs ferried to Kubinka AB from Gor'kiy by factory test pilots. All pilots in the regiment flew the new planes solo during March and April. Later the regiment was given a full complement of 40 early-production missile-armed MiG-21F-13s. Pilots with the 1st Sqn and the 2nd Sqn were first to convert to the new fighter, while the 3rd Sqn kept on flying their MiG-19s for a while.

In mid-October 1960, five MiG-21Fs were ferried to the GK NII VVS main test facility in Akhtoobinsk (the airfield was then called Vladimirovka AB) for operational evaluation under the Air Force Commander-in-Chief's plan. 500 test sorties were to be flown at the bombing range within six months to test the whole weapons suite – cannons, unguided rockets and bombs. L. K. Kuganyok, a former 32nd GvIAP pilot and a participant in the programme, reminisces:

'The MiG-21F's operational evaluation began in late November 1960. A flight test programme was drawn up for each of our aircraft involved, including a certain number of flying hours to be logged. I remember a sortie in a two-ship formation to test-fire the cannons in a 30-degree climb. Once my flight leader ordered, "Fire!", I pressed the triggers and kept them depressed until I ran out of ammunition. When the cannons fell silent, we went into level flight, and suddenly our own projectiles started exploding 300-350 m [980-1,150 ft] in front of us. The thing is, the 30-mm projectiles were fitted with self-destructs set at a 6-7-second delay. Projectiles self-destructed unless they hit the target within this period. Since we fired during a climb and then recovered to level flight, the projectiles and our aircraft covered different distances at the time, with the projectiles following a curved trajectory and the fighters following a straight flight path. As a result, we were almost hit by our own ammo. To avoid such incidents in the future, further live-fire sorties followed a modified scenario.

With the mission accomplished, I noticed on landing approach after the landing gear had been down that the right green light indicating "Gear Down" was not showing. Most probably, it conked out due to heavy vibration caused by firing the cannons. I reported to the flight operations director, "The right one is not showing", and began to try to see if the landing gear was extended, using other tricks – checking the pressure in the hydraulic system and the extension of the so-called "little soldier" (a slang name for a mechanical gear position indicator protruding from a wing panel when the relevant strut extended). With the pilot wearing a pressure helmet and unable to turn his head freely, seeing the "little soldier" protruding from the delta wing was not always possible. It took me some time to check that the landing gear had extended and the flight operations officer to permit me to approach for landing. Meanwhile, I forgot to do a very important thing – extend the flaps. The aircraft glided at an unusually high angle of attack, which, however, caused no doubt either on my or the flight operations officer's part. As a result, I landed at an inadmissibly high alpha, scraping the runway with the rear fuselage.'

In the summer of 1961, the 32nd GvIAP demonstrated its latest aircraft during an air parade in Tushino. The national leadership headed by Nikita S. Khrushchov decided to unveil the Soviet air power before the world. The world was duly shocked, because nobody in the West had suspected so large a number of advanced Soviet jet aircraft. N. D. Pudovkin, a pilot with 32nd Guards, reminisces about the preparations for the air parade:

'Preparing for the Tushino air parade in July 1961, the commander of the 9th IAD, Gen. A. V. Astakhov, tasked us with furnishing a column of MiG-21F-13 flights in addition to the aerobatic display team of the 234th GvIAP. The divisional commander himself headed the column on a MiG-21F-13 – he was the leader of the first 'vic'. The second 'vic' was led by Lt.-Col. Shibanov, the CO of the 32nd GvIAP, with the third 'vic' headed by Maj. Karamushka. The 'vics' flew at a separation of 500-700 m [1,640-2,300

ft]. Maintaining the distance turned out to be the hardest part. During the early training sorties, pilots would fail to do so, and the flights would approach one another too close or lag too far behind, especially when approaching Tushino with the leading 'vic' accelerating. The 'vics' had to pass Tushino airfield at a speed of 1,000-1,100 km/h [621-683 mph]. Each training sortie would be filmed, and the films would be shown to the pilots during debriefing. To maintain the distance, the pilots had to use a trick – apply the airbrakes. A lot depended on the leader: a flight's wake was rather strong and would throw any rear aircraft flying into it out of the formation. This happened to pilot Barmenkov during the dress rehearsal of the air parade. This actually occurred after the flypast over Tushino, when the column of flights started climbing. Barmenkov's aircraft hit wake turbulence and was thrown out of formation upwards and to the left at about 200 m [660 ft] in the wink of an eye.'

Indian Air Force officers, whose government intended to buy a licence to produce the MiG-21 in India, visited the 32nd GvIAP in the spring of 1961. The latest MiG-21F-13s were demonstrated to them. Following a brief familiarisation with the cockpit and controls, two Indian test pilots took turns at one of the fighters, flying it solo (there was no two-seater version at the time). Col. Stepan A. Mikoyan, a GK NII VVS test pilot, acted as an instructor pilot (IP) and an interpreter. The Indian pilots noted that the Soviet fighter was more manoeuvrable and easier to fly than the Dassault Mirage III and Lockheed F-104 Starfighter they had had an opportunity to fly, but the French and US aircraft featured more sophisticated avionics and were more comfortable.

In the early summer of 1962, the 32nd GvIAP's 2nd Sqn led by Maj. Yu.Yu. Nemtsevich and beefed up with flight and ground crews from the regiment's other squadrons was tasked with going to Indonesia to provide military assistance 'in the liberation fight against the Dutch colonisers'. The squadron's technical staff left Moscow in July, with aircrews following suit on 1st August. Il'yushin IL-18 airliners flew both groups from Sheremet'yevo airport to Jakarta via Tashkent, New Delhi and Rangoon.

The pilots arrived at Jakarta on 2nd August. The planes were shipped in containers by sea. At Jakarta airport they were reassembled and check-flown, after which the squadron redeployed to Madiun airfield. At Madiun, it was tasked with providing air defence coverage to the port of Surabaya, the main naval base of Indonesia. The mission was carried out by means of combat air patrols (CAP) conducted by two ship flights. The fighters carried two K-13 missiles. The fighter utility rate was low, 2-3 sorties a day, but even those were no easy thing in the tropical climate, with the pilots having to wear G-suits and helmets. The ground crews were having a hard time too. The planes were housed in hangars with galvanised iron roofs and the temperature inside exceeded +40°C (104°F). Conversion training of Indonesian flight crews was being conducted at the same time.

The squadron had been on detachment in Indonesia until October 1962 and, before going home, had handed the aircraft over to the Indonesians, who fielded them with the 14th Sqn of the Indonesian Air Force.

After the 2nd Sqn had started gearing up for detachment to Indonesia, taking their aircraft with them, the regiment was augmented back to full strength with flight and ground crews from the fighter air regiment stationed at Beryoza AFB in Belorussia. Early in July 1962, there was a meeting of the personnel of 32nd GvIAP and its support elements, during which the Moscow Military District aviation commander, Gen. Yevgeniy M. Gorbatyuk, tasked them with preparing for redeployment to a training area abroad to conduct 'flight training' there. The operation was top secret. The personnel were vetted by the counter-intelligence service, underwent stringent medicals and were inoculated. The regiment was manned and equipped to war-time standard. It operated 40 MiG-21F-13 fighters, six UTI MiG-15 two-seat trainers and a Yak-12M liaison aircraft. On 10th-13th July 1962, the 2nd Sqn led by Maj. A. M. Yeliseyev conducted live fire exercises on their MiG-21F-13s at the firing range, attacking aerial and ground targets. The regiment's deployment abroad took place between 2nd August and 22nd September 1962.

The deployment of the Soviet troops to Cuba was part of Operation *Anadyr'*. 43,000 personnel and materiel were deployed to the island in August and September 1962. The mainstay of the task force, which was dubbed the Group of Soviet Forces in Cuba, was a strategic missile division. In mid-September 1962, two weeks after departing from the port of Baltiysk, the freighter M/V *Nikolayevsk* carrying the pilots and mechanics of the 32nd GvIAP docked in the port of La Isabella. Once in Cuba, the regiment became subject to operational control of the 12th Air Defence Division. When the personnel disembarked, they were brought to the airbase on the outskirts of Santa Clara. The airfield was virtually in the middle of the island, which

V.V.Sharkov archive

▲ **32nd GvIAP/2nd SqnMiG-21F-13 '23 Red' undergoes maintenance at San Antonio de los Baños in 1963. Note the open door of the rear avionics bay.**

enabled the fighters to control the airspace over central Cuba. The US-built airbase had a runway 2,500 m (8,200 ft) long and 47 m (154 ft) wide and was equipped with an instrument landing system. A Cuban Air Force (FAR – *Fuerza Aérea Revolucionaria*) squadron flying MiG-15*bis* *Fagot-B* fighters was stationed there.

The containers housing the MiG-21s were hauled from the port to the airbase by heavy lorries driven by Soviet and Cuban drivers and escorted by local police. At the airfield, the containers were put in special areas. Assembling the fighters proved to be very difficult. Crates with detachable equipment and drop tanks had to be hauled out of the containers: all fixtures had to be detached from the fuselages, wing panels and stabilisers; the fuselages had to be rolled out of the containers and the then wing panels, each weighing more than a tonne, had to be manhandled. Wing panels were attached to fuselages manually too. At first, the ground crews had handled the assembly work alone, but later on the pilots joined in as well. With the first planes assembled and engines 'de-mothballed', engine runs began but always resulted in fires. The reason was pinpointed quickly: the engines' starting system proved to be maladjusted to the hot humid climate. Once the engines had been adjusted, they began to start without a hitch. However, the surprises provided by the tropical climate did not stop at that. Another major deficiency cropped up – fuel leaks. During the journey, the fuel cells made of rubberised fabric were empty, with tiny cracks developing in their folds. Replacement fuel cells were quickly flown in from the USSR.

32nd GvIAP pilots in civilian clothes pose beside a Cuban Air Force MiG-21F-13 on QRA duty, November 1962. Left to right: L. K. Kuganyok, V. M. Vasil'yev, I. V. Bobkov and B. N. Sergeyev. ▼

L.K.Kuganyok archive

The planes were assembled and ground tested first. The completed MiG-21F-13s were parked along a pre-painted white line without camouflage, as if on parade. Their red star insignia were painted over with white paint. The resident Cuban MiG-15*bis* fighters were dispersed throughout the base in concrete shelters. After a US reconnaissance plane passed over the Soviet MiGs' flight line on a September day, the Soviet command's reaction was quick and tough – with the advice and consent of the Cubans, all MiG-21s were stashed into the shelters instead of the Cuban fighters and the rest of the material was dispersed throughout the air base and camouflaged.

The situation required Soviet pilots to start flying as soon as possible, because US fighters would reconnoitre the air base virtually every day. At the time, no production MiG-21U two-seaters were available, and the six UTI MiG-15 fighter trainers were the last to arrive in Cuba. In that situation, Col. N. V. Shibanov, the CO of the regiment, ordered combat aircraft flying, omitting introductory flights on MiG-15 trainers. The regimental navigator, Lt.-Col. Grol', was the first to fly his MiG-21F-13 on 18th September, with the rest of the Soviet pilots check-flying their MiGs on the following days. Thus, the regiment was placed on alert duty in Cuba by late September 1962.

The first alarm was sounded on the night of 22nd October. US warships were reported to be heading towards Cuba. Orders came for the fighters to stand by for scrambling. Drop tanks and two FFAR pods per plane were mounted. Pilots climbed into the cockpits in pitch darkness. War could break out at any moment but they were not confused – rather, composed and waiting to see which way the cat jumped. The alert was called off late that night.

The regiment's dispersal was ordered on 24 October 1962. The 1st Sqn and command

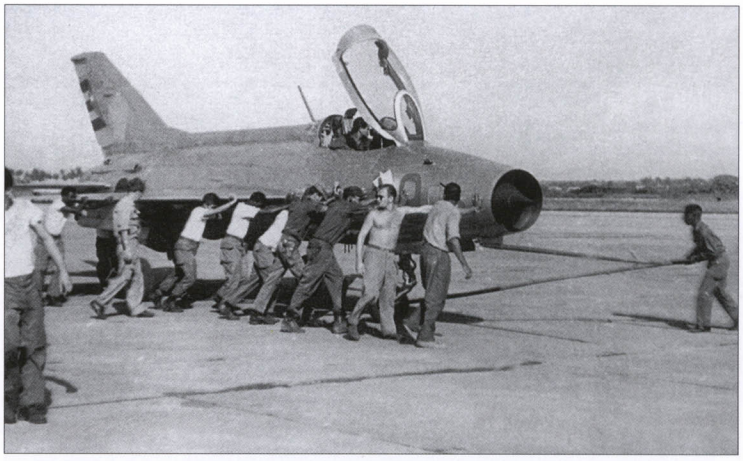
element remained in Santa Clara, the 2nd Sqn moved to San Antonio de los Baños airbase in the vicinity of Havana and the 3rd Sqn went to Camagüey airfield in the east-central part of Cuba. A pair of MiG-21F-13s would be on quick-reaction alert (QRA) duty in the daytime at each air base and one fighter with the most seasoned pilot in the squadron at night.

US fighters started putting in an appearance over San Antonio de los Baños AB, where the 2nd Sqn was deployed, every day between 10.00hrs and 11.00hrs. Scheduled MiG-21F-13 flights were under way at San Antonio on 4th November. After Maj. D.V. Bobrov was airborne, a pair of US fighters arrived at low altitude and low speed. The flight operations officer, Lt.-Col. S. M. Perovskiy, ordered Bobrov to attack the Americans without opening fire. As soon as the US pilots saw a MiG-21 on their tails, they went into full afterburner at once and departed towards the sea. They did not fly over the base again. US radio broadcasts reported, 'US aircraft have been attacked in the skies over Cuba by air pirates in unmarked aircraft'. This prompted the application of FAR insignia on all regimental MiGs overnight.

Combat training continued. The pilots practiced combat operations, formation cohesion and cooperation with Cuban MiG-15s and MiG-19s as well.

With the passage of time, another serious fault emerged – the cockpit transparency would start to become opaque and hairline cracks appeared due to the ultraviolet radiation from the scorching tropical sun. The process proved to be irreversible despite the efforts made by the maintainers. New transparencies had to be flown in from the Soviet Union to replace the old ones on all fighters.

In early 1963, the regiment was tasked with converting the Cuban air and ground crews to the MiG-21. San Antonio de los Baños AB was selected as the aircrew and ground crew conversion centre. The base had the largest airfield in Cuba with three concrete radial runways about 3 km in length and a developed infrastructure. Once the official conversion order came in February 1963, the Soviet pilots flew solo only to maintain proficiency. The conversion of the Cubans was completed by midsummer, with about 30 pilots and all ground crews trained in flying and maintaining the MiG-21. No flight accidents or preconditions for them happened. With the 'flight training mission' in Cuba accomplished, the personnel of the 32nd GvIAP returned home and their fighters were handed over to the Cuban Air Force.



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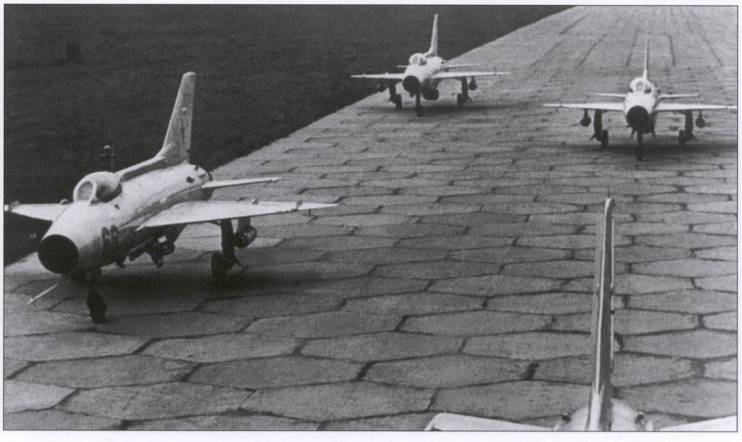
▲ **Cuban ground personnel manhandling a MiG-21F-13 after a solo flight by a Cuban pilot.**

Full-rate production of the interceptor was being launched meanwhile. First-line unit pilots learning to fly it were facing problems. Operation of MiG-21PFs by combat units had been restricted by March 1964 due to engine flameouts during launch of FFARs at combat power settings, the underdeveloped weapon systems and ineffective sights. There were seven MiG-21F-13 flight accidents in 1961, with flight time per flight accident being 2,579 flying hours. Three of the accidents were caused by design flaws or manufacturing troubles, with flight time per malfunction totalling 6,018 flying hours. Ground crews complained of the design's poor maintainability – maintenance was indeed very difficult. An engine change was quite a big event and took a long time to do, and access to units and assemblies was very difficult.

Pilots honed their flying skills in the course of operating their MiG-21s, and three years later, in 1964, the time per flight accident totalled as many as 3,198 flying hours. Nonetheless,

A quartet of Soviet Air Force MiG-21F-13s fitted with UB-16-57 FFAR pods taxies out for a formation take-off at Kubinka AB. ▼



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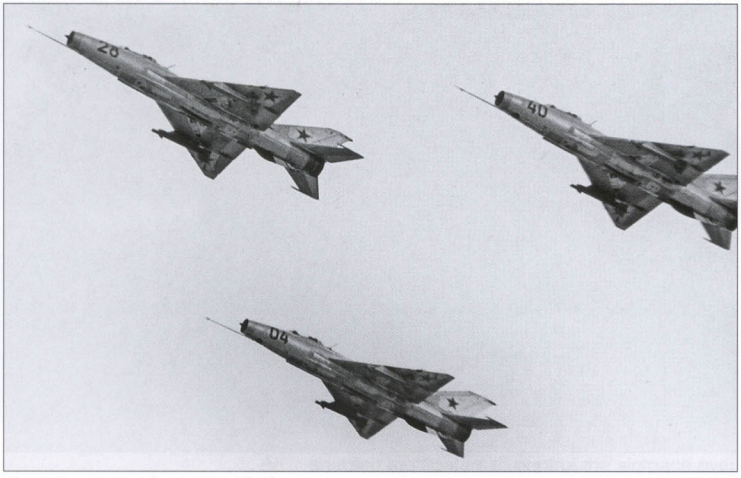

MiG-21F-13s with R-3S AAMs make a flypast in V formation at Moscow-Tushino. ▲

A ground instructional airframe composed of a MiG-21PF nose and a MiG-21F tail. The legend on the nose reads *Trenazhor* (simulator or instructional airframe). ▼

'Gentlemen, synchronise your watches.' 32nd GvIAP MiG-21PFs are parked on a taxiway at Kubinka AB, poised for a mass formation take-off in 1967. ▼▼

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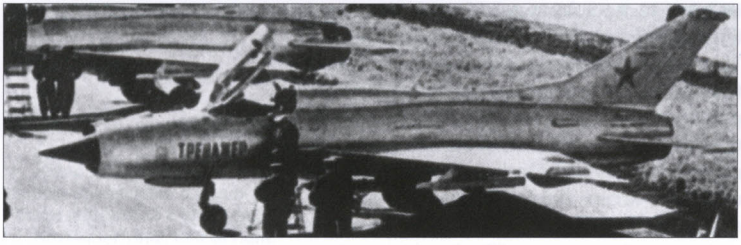


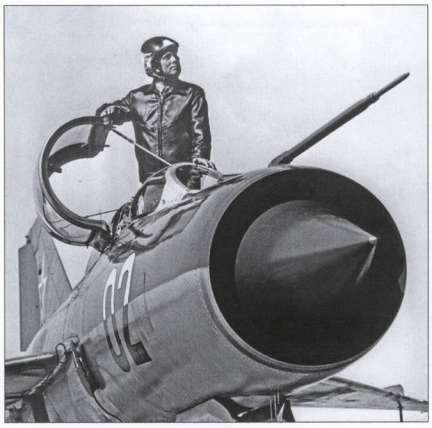
MiG-21s suffered 19 flight accidents that year, though only four were due to design flaws or manufacturing defects, and flight time for one of them was 15,989 flying hours. 1963-64 saw six flight accidents in the Warsaw Pact air forces – two in Hungary (including a crash), three in the German Democratic Republic and one in Poland. In addition, Syria and Finland had one flight accident each as well. Most failures were caused by the R11F-300 engines, and the one in Finland by a nozzle guide vane burn-through. In the Soviet Union, combat unit MiG-21F-13 aircraft suffered two non-fatal flight accidents and a MiG-21U at Plant 31 in Tbilisi crashed in 1964, all due to the failure of their turbojet engines. MiG-21PF interceptors suffered several non-fatal accidents for the same reasons in the same year, too.

The 50th anniversary of the October Revolution of 1917 served as an occasion for a huge aircraft demonstration in Moscow. The Moscow air parade in the skies of Domodedovo airport on 9th July 1967 was graced with several dozen MiG-21 warplanes, all of which were from Kubinka AFB, including the display team. Col. Likhachov flew solo aerobatics in a MiG-21PFM. A foursome of early-production MiG-21PFMs (with the old SK ejection seats and forward-hinged canopies) sporting a striking silver/red colour scheme, which flew earlier during the parade, landed right in front of the crowd and then took off after some taxiing to entertain the public. The same year, pilots of the 234th GvIAP flew their MiG-21PFMs in diamond-seven and diamond-nine formations seven times at

G.Omel'chuk

Kubinka AB, demonstrating their aircraft to foreign delegations. The MiG-21PFM display team performed aerobatics for foreign delegations 13 times.

The early-production MiG-21PF, MiG-21PFS and MiG-21PFM interceptors were eventually displaced by more advanced derivatives – the MiG-21S, MiG-21SM and MiG-21*bis*. Those of the ousted interceptors which still had enough service life left were handed over to fighter-bomber regiments or Air Force flying colleges. For instance, the MiG-21PFMs of the 136th Fighter-Bomber Regiment (APIB – ***avia*polk** *istre***bit***eley-bombardi***rov***shchikov**) and the 50th Independent Composite Air Regiment (OSAP – *ot***del'***nyy* ***smesh****annyy* ***avia*polk**) fought in Afghanistan. Among other missions, the former interceptors flew suppression of enemy air defence (SEAD) and ground attack sorties. The Kubinka-based 'showcase' 234th GvIAP was also issued with advanced fighters. However, their aircraft were MiG-21MFs – an export version not intended for the Soviet Air Force; they were issued to the regiment because Kubinka AB had become a place to demonstrate Soviet aircraft to prospective foreign customers. Fighters of the type in service with the 234th GvIAP flew to Reims-Champagne AB in France on a goodwill visit on 9th June 1971. July 1977 witnessed French Air Force Dassault Mirage pilots with the EC 02.030 'Normandie-Niémen' squadron arrive on a goodwill visit at Kubinka AB where they had an opportunity to familiarise themselves with the latest production version of the fighter, the MiG-21*bis*. A year later, MiG-21*bis* fighters paid a reciprocal visit to France and also visited Kuopio-Rissala AB in Finland.



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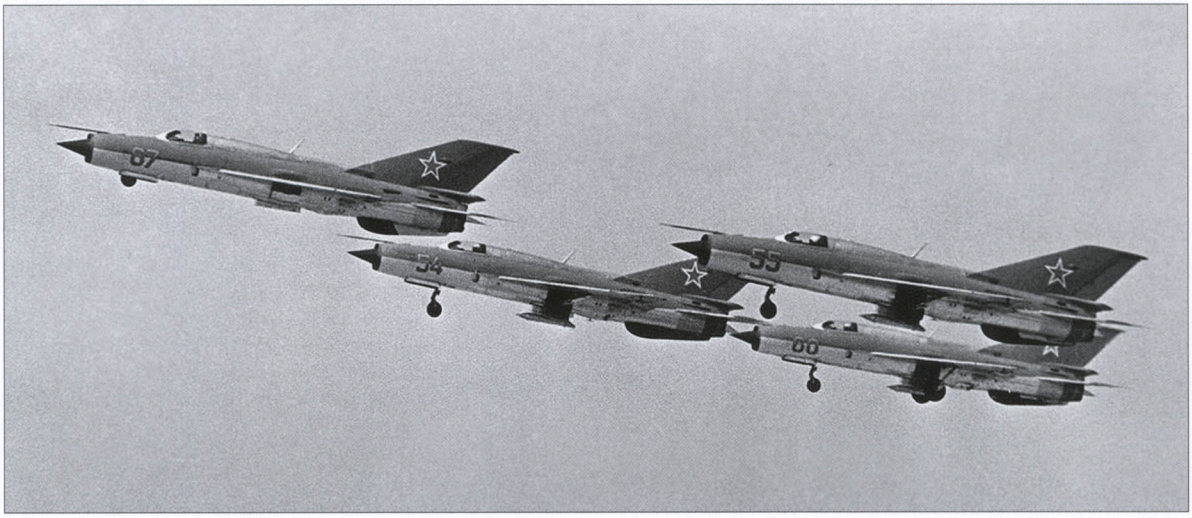
Red-topped MiG-21PFM '02' was one of several operated by the 4th Squadron of the 234th GvIAP – the display team from Kubinka AB. Note how the colour division line runs right across the tactical code, which is part red and part silver.

The reader might be interested to know the dynamics of Soviet fighter regiments' transition to aircraft of more advanced types. Reliable data on two regiments is given below as an example of that transition.

In 1960, the 14th GvIAP of the 275th IAD, which was part of the Soviet contingent in Hungary (later called the Southern Group of Forces) and stationed at Kalocsa airbase, took delivery of the first production MiG-21F and MiG-21F-13 fighters. On 27th June 1960, the regiment was assigned to the 195th GvIAD and redeployed to Kiskunlacháza AB. The unit's personnel learnt the ropes on all new derivatives and took on the conversion to the MiG-21PF in 1961. In 1970 the 14th GvIAP began reequipping with the MiG-21SM. Only in May 1979 did it start converting to the MiG-23. The regiment left Hungary in the spring of 1999, redeploying to an airbase near Kursk in central Russia.

Four red-topped 234th GvIAP MiG-21PFMs with early-model one-piece canopies 'clean up' after take-off. All except the lead aircraft are carrying smoke generator pods on the centreline. ▼



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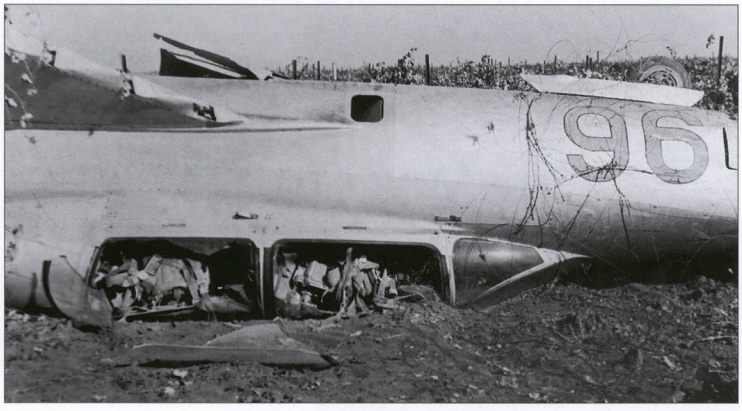
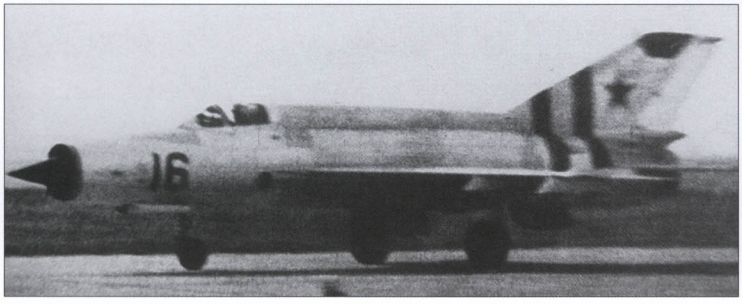


▲ **MiG-21US '96 Red' lies inverted after an off-field forced landing. The canopies have been smashed to extract the pilots.**

▲ **This MiG-21US suffered an engine fire at Ivano-Frankovsk in March 1967 and overran during an aborted take-off. The aircraft is a total loss.**

This MiG-21S was among the Soviet aircraft used in the invasion of Czechoslovakia in 1968, hence the red stripes. ▼



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The 159th *Novorossiysk* GvIAP bearing the Red Banner Order and the Order of Suvorov (3rd Degree), which was part of the Soviet contingent in Poland (later called the Northern Group of Forces) and stationed at Żagań airbase in 1961, had 25 MiG-15*bis* fighters, five MiG-17P interceptors, five MiG-17PFs and eight MiG-21Fs. In 1963, the regiment flew four MiG-21Fs and 21 MiG-21F-13s. In 1964, the regiment, which had been redeployed to Kluczewo AB, had 14 MiG-21F-13s and 12 MiG-21PF interceptors in its inventory; as many as 29 MiG-21PFs and 12 MiG-21PFMs in 1965; 40 MIG-21R tactical reconnaissance aircraft and 14 MiG-21PFM interceptors in 1967; 39 MiG-21Rs and two MiG-21U two-seaters in 1968; and 26 MiG-21Rs and 14 MiG-21SM fighters from 1970. The number of MiG-21SMs increased to 39 in 1971; that year the regiment took delivery of five MiG-21UM trainers. Next, the 159th GvIAP operated the MiG-21SMT from the mid-1970s to 1987, after which it began to convert to the Su-27 fourth-generation fighter.

The Soviet Air Force fighter units became more combat-capable once they converted to the MiG-21S and especially to the MiG-21SM which, unlike the former, carried not only four AAMs but had a built-in cannon as well. Pilots who had converted to the MiG-21SM from the MiG-21PF, MiG-21PFM or MiG-21S would forget about the cannon because the older variants lacked it and the GP-9 gun pods were seldom mounted. It is worth mentioning a uniquely revealing event of the combat use of a MiG-21, which took place in the autumn of 1973 in the skies over the Soviet Transcaucasia.

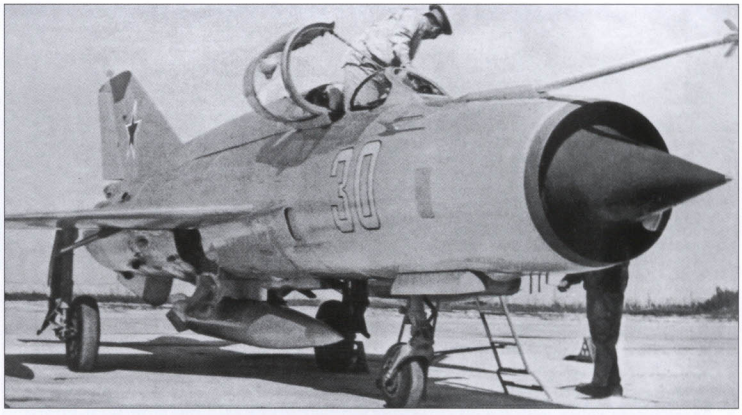
A MiG-21SM pilot, Capt. Ghennady N. Yeliseyev, who was on duty at Vaziani AB in Georgia, was scrambled on 28th November 1973 to intercept an Imperial Iranian Air Force plane that had intruded into Soviet airspace in the vicinity of the Mugan Valley (Azerbaijan). He caught up with the intruder when it was very close to the border. The regimental CP ordered the intruder downed at all costs, even through radar displays showed that there was not enough time for Yeliseyev to use the missiles. Quite possibly the pilot simply forgot that his aircraft had a cannon (the regiment had only one fighter with the integral cannon, and Yeliseyev was flying it). This is why he took the fatal decision to ram the Iranian. It is possible that he was ordered to do so by the CP, but the fact remains that the Soviet pilot hit the Iranian plane's tail with the wing of his fighter. The collision resulted in an explosion, both aircraft going down in a shower of debris. Yeliseyev died, and the intruder's crew – an Iranian trainee and a US instructor pilot – survived. Capt. Yeliseyev was posthumously awarded the title of Hero of the Soviet Union (the top Soviet military award bestowed along with a Golden Star medal and an Order of Lenin).

The MiG-21SMT, fielded with several air regiments in the MiG-21SM's footsteps, was not popular with first-line pilots due to its inferior handling characteristics, and complaints about the aircraft were addressed to the Air Force's senior officers much too often. Once most of the MiG-21SMTs had been converted *in situ* to MiG-21ST standard, their appearance became

virtually indistinguishable from that of the MiG-21*bis* fighter, which had just begun to enter service. The arrival of the MiG-21*bis* heralded a new era in Soviet fighter aviation.

After the MiG-21F-13, the MiG-21*bis* was probably the most refined derivative of the baseline MiG-21. Pilots came to like it, and rightly so. Having retained the handling characteristics of the early interceptors, it was far more combat-capable owing to its more sophisticated avionics and weapons suites. The Soviet Air Force had finally got a fighter that was believed to be on a par with the most advanced USAF warplanes of the time.

Mention should also be made that production MiG-21s were fielded by regiments of both the Air Force's Tactical Aviation and the Air Defence Force's (PVO's) fighter arm, which for a long time had relied chiefly on aircraft developed by the design bureau led by Pavel O. Sukhoi. A number of PVO pilots had a chance to fly both Sukhoi interceptors and MiG fighters. The MiG-21PF and PFM was inferior to the Su-9 in altitude performance and range but superior in terms of manoeuvrability; for example, its sustained turn radius and time were, respectively, far tighter and shorter. The same was also true for vertical manoeuvres. The MiG-21's engine was easier to operate because it had fewer anti-surge controls and no limitation as to how many times the afterburner could be turned on. The MiG-21PFM was perceived as a simple and reliable aircraft for inexperienced pilots and flying-school cadets, especially easy to handle on landing because it never ballooned and took rough landings in stride. The MiG-21 and the Su-9 were also easy to manoeuvre, both aircraft turning around their longitudinal axis with ease in multiple rolls. Both were tolerant to piloting errors at high alpha and were difficult to stall, let



via RART

▲ **234th GvIAP MiG-21MF '30 Blue' in ferry configuration with three drop tanks seen during a courtesy visit to Reims-Champagne AB in 1971.**

Silver-painted MiG-21SMTs on the flight line as the whole regiment prepares to take off. ▼

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All photos Yefim Gordon archive

▲ **Camouflaged Soviet Air Force MiG-21*bis* share the flight line with silver-painted Democratic Republic of Afghanistan Air Force sister ships, with Soviet Mil' Mi-6 helicopters and Antonov An-12 transports parked beyond.**

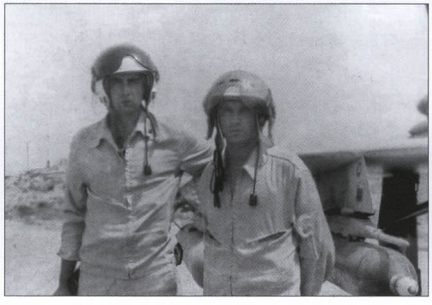
alone spin, and would easily recover from a stall. Air crews would also mention the pilot escape system as an important feature of the MiG-21. Starting with Batch 15, the MiG-21PFM was equipped with the KM-1 ejection seat enabling the pilot to punch out at a speed of 140 km/h (87 mph) at zero altitude. The Su-9's ejection seat only allowed ejection at an altitude of more than 50 m (164 ft) and at a speed of over 300 km/h (186 mph). The Su-9 climbed to 12,000 m (39,370 ft) in one minute flat but the engine of the MiG-21*bis* had a contingency rating, in which its thrust exceeded 9,000 kgp (19,840 lbst) and the fighter's thrust/weight ratio exceeded 1. In this mode the MiG-21*bis* surpassed the Su-9 in all respects for a short duration, though its low fuel capacity ensured its altitude performance and range remained inferior to that of the Su-9. Thus, the Su-9 was better suited for intercepting a target at maximum range and maximum altitude, while the MiG-21*bis* packing four or even six missiles was a better dogfighter.

In addition to countering intruders, MiG-21 interceptors were used for destroying automatic reconnaissance balloons coming across the border. Balloons that looked harmless on the face of it were, in fact, a constant thorn in the side of the Soviet air defence forces. Carrying ELINT gear, aerial cameras and air sampling equipment, they gathered valuable intelligence, often crossing the Soviet Union west to east. Worse still, they presented a serious threat of collision with civil and military aircraft, especially as the balloon's equipment container was painted blue for low visibility. Countering them was a difficult thing to do and was not always successful. For instance, Soviet radars spotted 4,112 automatic drifting balloons between 1956 and 1977, with only 793 of them shot down by fighter aircraft.

As far as MiG-21 operations against drifting reconnaissance balloons are concerned, a good case in point is the period from 11th August to 14th September 1977, when interceptors of other types were involved in counter-balloon operations. At the time, 11 balloons intruded, drifting at 11,000-14,000 m (36,090-45,930 ft) at a speed of about 200 km/h (124 mph). Up to 16 fighters had to be scrambled to deal with each of

927th IAP pilots pose with one of the unit's MiG-21*bis* fighters at Bagram in 1983. ▼

▶ **927th IAP pilots beside a MiG-21*bis* armed with four S-24 unguided rockets.**



▶ **This MiG-21*bis* carries two ZB-500 napalm tanks.**

them. The aircraft used air-to-air missiles, FFARs and cannons.

The Afghan War proved to be an ordeal to the Soviet Air Force. The war was officially termed an operation 'to assist the people and the government of Afghanistan in their fight against the aggression'. At first, the service was about to detach to Afghanistan squadrons of the regiments operating the MiG-21SMT, because the fighter's increased fuel capacity provided it with the longer endurance so needed for operations over mountains and deserts lacking reference points. However, the heavy MiG-21SMT disliked by the pilots was not deployed to Afghanistan, the aircraft fleet of the Limited Contingent of Soviet Forces in Afghanistan (OKSV – *Ogra**nich**ennyy kontin**ghent** so**vet**skikh voysk*, alias the 40th Army) initially being made up of MiG-21*bis* fighters only. The MiG-21SMT's field performance was not as good as that of the MiG-21*bis*. In addition, there was flight instability when flying on full tanks, which was especially noticeable in the rarefied mountain air. Later on, the OKSV's air arm was beefed up with MiG-21R tactical reconnaissance planes and MiG-21PFM interceptors that had been taken over by fighter-bomber regiments following the MiG-21R's removal from fighter regiments. For instance, at the beginning of 1980 the 40th Army's combat air element comprised 14 MiG-21*bis* aircraft as part of a squadron of the 115th IAP at Bagram, ten MiG-21Rs flown by a squadron of the 87th Independent Reconnaissance Air Regiment at Kandahar and 13 MiG-21PFM fighter-bombers as part of a squadron of the 136th APIB, also at Kandahar. Afterwards, the air arm of the 40th Army was beefed up with the Kabul-based 50th

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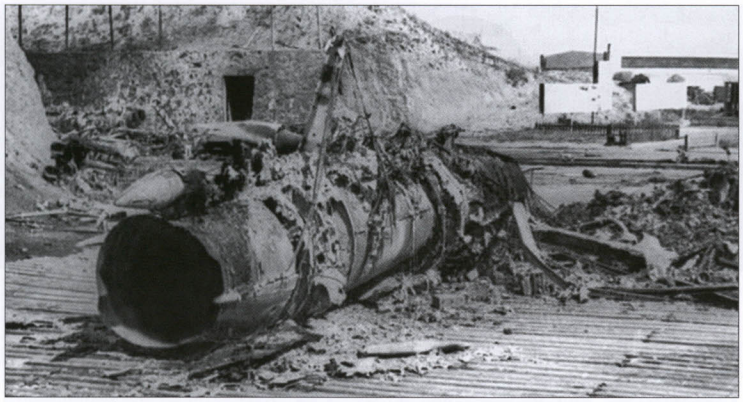
▲
A MiG-21*bis* toting 250-kg bombs flies over the mountains of Afghanistan.

151st GvIAP pilots walk past their MiG-21*bis* fighters at Bagram in 1982.
▼

ITAR-TASS



▲
A MiG-21 destroyed on the ground by a Mujahideen mortar strike.

◄
Another victim of enemy action. Note that the hardstand is surfaced with perforated steel planking.

◄
A MiG-21*bis* coded '57 Red' in a rather undignified position after a crash landing when the nose gear failed to extend. Note the white-edged code.

The same aircraft after recovery from the runway. The extent of the damage is visible.
▼

All photos Yefim Gordon archive

OSAP comprising 16 MiG-21PFMs, a number of Antonov An-26 and An-12 airlifters, Mil' Mi-24 attack helicopters and Mi-8 utility helicopters. Fighter units deployed to Afghanistan would leave part of their establishment of aircraft at their air bases in the Soviet Union, so that their bases were not left empty-handed. In Afghanistan, they normally consisted of two reinforced air squadrons totalling 30-35 aircraft.

The 927th *Königsberg* Red Banner Order & Order of Alexander Nevsky IAP, garrisoned at Beryoza AFB in Belorussia, fought in the Afghan War between June 1983 and July 1984. With MiG-21*bis* fighters in its inventory at the time, the regiment featured highly skilled air crews. Virtually all pilots who went to Afghanistan were qualified as Pilots 1st Class, with many having gained experience in Cuba, Egypt, Ethiopia and Vietnam. Col. P. P. Tarasevich was the 927th IAP's CO. Although the regiment had had to deploy to Afghanistan at short notice, there were no major problems with the pilots' proficiency. The pilots would train at the bombing range regularly, passing bombing, gunnery and rocket strike tests for other Belorussian Military District air units (surprisingly, no punitive measures were taken for such trickery). Selected personnel and their aircraft headed for Afghanistan on 13th June; a total of 28 combat aircraft and four MiG-21UM trainers went on detachment. The regiment arrived at Bagram airbase on 25th June. Sorties were flown mostly to attack ground targets, while reconnaissance and escort missions (when the MiGs were called upon to escort fighter-bombers, helicopters and An-30 photo survey aircraft) were a rarer event. From time to time, the MiG-21s would scramble to intercept Pakistani aircraft intruding into Afghan airspace (aircraft of the 40th Army pulled alert duty at Bagram, Shindand and Kandahar air bases). Overall 25-30 per cent of the sorties were dedicated to attacks on assigned targets.

On-call strikes were conducted on orders from the 40th Army HQ or a 40th Army staff

officer on board an Antonov An-26RT communications relay aircraft. The composition of the package and its weapons fit would be determined (aircraft with different weapons fits would be prepared in advance) and target coordinates would be conveyed in no time, with the aircraft managing to scramble within 10-12 min. after receiving the order. Interestingly, on the Afghan theatre of operations the MiG-21 was dubbed *ve**syo**lyy* ('the jolly one'), probably for its speed and agility, and calls for MiG-21s were often radioed virtually in the clear – for example, 'Send a flight of the jolly ones to such-and-such an area'.

Fighting such an enemy as the Mujahideen guerrillas called for special tactics. Thus, consecutive strikes against ground targets by four strike plus support packages became the basic tactic used by Soviet aircraft in Afghanistan. The first package, which handled the SEAD task and comprised two to four MiG-21s, would clobber the target area and mountain slopes on both sides of the anticipated bombing run, using cluster bombs and S-5 FFARs. It would be followed by a target designation package made up of two Mi-8 helicopters with forward air controllers (FACs) on board and designed to designate the target with their bomb or FFAR explosions (this task could be carried out by a couple of aircraft with the strike package). With the target designated, the strike package (four to eight MiG-21*bis* aircraft) would attack, and the bombing damage assessment (BDA) package (two MiG-21R reconnaissance aircraft or Mi-8 choppers) would complete the mission. If preassigned targets were attacked, different aviation forces would operate in conjunction, using composite strike and support packages, such as a four to eight MiG-21 or Su-17 strike package (MiG-21s would normally carry four OFAB-250-270 HE/fragmentation bombs and the ammunition for the GSh-23 cannon), a target designation package followed by the SEAD package (two to four MiG-21s or Su-17s), an escort package (two to four MiG-21s or the same number of Mi-24 helicopters), a demonstration package (two MiG-21s or Su-17s) and, finally, the BDA package (two MiG-21Rs).

When tasking the aviators, the 40th Army's command did not especially differentiate between fighter and fighter-bomber squadrons. Fighter pilots were on a par with their fighter-bomber colleagues as far as combat skills are concerned. Although the sighting gear on the MiG-21*bis* fighter was pretty basic (the plane mounted only the ASP-PFD gunsight), it is the skills and experience of pilots taking sight 'by means of the tip of the pitot static boom' that mattered in mountainous terrain, rather than high-tech automatic sights.

The MiG-21*bis* carried up to a tonne (2,205 lb) of bombs, but normally its payload was limited to two 250-kg bombs (the engine's thrust dropped by 10-15 per cent due to the rarefied mountain air and high ambient temperature). Under such conditions, its take-off run measured 1,500 m (4,920 ft) – well over the usual 850 m (2,790 ft) with a normal takeoff weight; when loaded with two 500-kg bombs, the fighter had a hard time taking off and its rate of climb dropped considerably, which was not safe. At the same time, carrying a heavier payload at the expense of the fuel load was dangerous, with pilots always preferring to have enough fuel to be sure of returning safely. Under the standard operational procedure, pilots were to head north and punch out in Soviet airspace after running out of fuel if they were unable to find their base in Afghanistan for some reason.

FAB-250M54 high-explosive bombs and OFAB-250-270 HE/fragmentation bombs with a kill zone of up to 1,200 m² (12,900 sq ft) were the weapons of choice for MiG-21 pilots, as were RBK-250-275 cluster bombs housing 150

A MiG-21R with a Type D camera pod on a mission over the Panjshir Valley, Afghanistan. ▼

Yefim Gordon archive

Field maintenance of a MiG-21*bis* in Afghanistan. Note the three-tone camouflage.

via Internet

AO-1SCh fragmentation bomblets each; the AO-1SCh weighed 1.2 kg (2.65 lb) and had a cast-iron case producing a hail of fragments lethal within a 12-m (40-ft) radius. The cluster bombs covered areas up to 4,800 m² (51,610 sq ft). Various versions of the S-5 FFAR were fired from UB-16-57 and UB-32-57 standard rocket pods. Large-calibre S-24 FFARs were employed as well.

During the Afghan War, the only specialist reconnaissance aircraft at the disposal of the 40th Army were the MiG-21Rs operated by the 263rd Independent Tactical Reconnaissance Squadron (OAETR – *ot**del'**naya **a**viaeskad**ril'**ya tak**tich**eskoy raz**ved**ki*). They carried pods housing day or night cameras, the TARK-2 television reconnaissance system and ELINT gear. The pods' mission equipment also included tape recorders for pilots to record their en-route observations. MiG crews conducted mostly visual reconnaissance, while Mi-8 helicopters carried photo cameras. MiG-21Rs took part in seek-and-destroy missions against Mujahideen convoys carrying arms, especially night ones. Their pilots knew best of all where to find targets and conducted 'free chase' sorties – independent seek-and-destroy operations. On such missions, they carried drop tanks and two RBK-250-270 cluster bombs or two to four S-24 FFARs. Reconnaissance aircraft also were used at night, illuminating target areas with SAB-100 or SAB-250 flare bombs for other aircraft attacking ground targets. The 40th Army's aircraft flew 10,860 reconnaissance missions, of which 2,708 were conducted by the 263rd OAETR (an average of 156 sorties per crew) and 8,125 by other units (an average of 35 sorties per crew). 607 sorties were made for the purpose of ELINT, developing radar operations in a whole number of Pakistani urban areas. Reconnaissance flights along the Afghan-Pakistani border were dangerous. For instance, Pakistani fighters attacked an Antonov An-26RT communications relay aircraft conducting such a mission at an altitude of 6,000 m east of the city of Jalalabad. The An-26RT survived owing to the timely arrival of a couple of MiG-21 fighters scrambled from Bagram airbase.

MiG-21US and MiG-21UM trainers were also subject to heavy use. In addition to training flights, the two-seaters were used for familiarisation missions, on which pilots learnt the lie of the land for future reconnaissance and target designation. A seasoned pilot or a navigator with good knowledge of the terrain usually occupied the instructor's seat. The two-seaters were also utilised for command and control during air attacks and for BDA.

Although many missions had to be flown pushing aircraft to the limit, the MiG-21 proved to be very reliable during the war. Combat ready aircraft totalled 85-90 per cent in their regiments, and there were few failures of even complex systems, such as navigation and communications equipment. Nonetheless, the harsh climate caused additional problems: the omnipresent dust would clog fuel filters, which could cause in-flight engine shutdown; wheel brakes would overheat. Furthermore, aircraft had to be repaired on site. They would often use up their life between major overhauls in a year, after which a return to the USSR was required.

Soviet MiG-21 pilots resting between sorties at Bagram. Some of the airmen are wearing hats of the kind issued to Soviet servicemen in the Central Asian military districts and in the tropics.

Yefim Gordon archive

Mention should be made that there were MiG-21 fighter in service with the Afghan Air Force as well, but Afghan pilots flew only two to three days a week and did not trouble themselves with combat missions. To enhance the effectiveness of operations, Soviet IPs often had to fly Afghan aircraft. Soviet pilots bore the brunt of the air operations in Afghanistan. Having spent a year in country, they would log as many as three times the annual peacetime flying hours, with some of the planes logging 450-470 sorties a year. The fighter pilots flew about 30 per cent more sorties than the fighter-bomber pilots did, with their sortie rate exceeding even that of attack aircraft crews. With the passage of time, the ever-growing workload prompted the command to double the strength of the OKSV air regiments, drawing more flight and ground crews from other units.

MiG-21s were lost for several reasons. Few were downed by anti-aircraft fire, because agile aircraft were no sitting ducks. However, there were no shelters on the ground to house the aircraft, and the Mujahideen often mounted mortar attacks on the airfields.

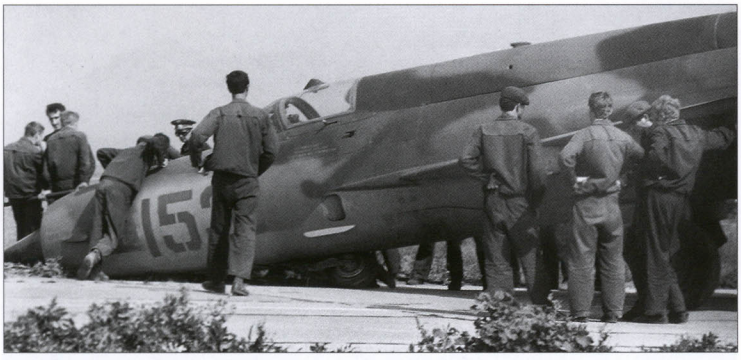
Yefim Gordon archive

▶ **A 'black man' checks the brake parachute of a MiG-21 before closing the clamshell doors.**

A row of MiG-21s on the snowbound ramp of the Barnaul Military Pilot College. ▼

Yefim Gordon

via Internet



Sergey Komissarov archive

▲
MiG-21SM '153 Red' operated by a Russian AF pilot college suffered a nose gear collapse after a hard landing.
▲▲
'51 White outline', a Russian Air Force MiG-21*bis*.

MiG-21SM '121 Yellow' features bird-scaring eyes and low-viz stars with no outline.
▼

In July 1984, the more advanced MiG-23ML fighters fitted with more powerful engines and the latest sights replaced the MiG-21*bis* aircraft in the 40th Army's inventory.

As mentioned above, many air regiments would have their obsolete MiG-21 variants replaced by newer models every seven to eight years. Aircraft that still had some of their service life left were passed on either to other first-line regiments or to Air Force academies. The Barnaul Military Pilot College (BVVAUL – *Barna**ool'**skoye **vys**sheye vo**yen**noye aviatsi-**on**noye oo**chil**ishche **lyot**chikov*) in Siberia is a case in point. At first, it received many MiG-21PF, MiG-21PFS and MiG-21PFM interceptors, which were followed some time later by MiG-21R reconnaissance aircraft and MiG-21S fighters. All those aircraft were used with a single purpose in mind – teaching inexperienced pilots to fly. Interestingly, when the Soviet fighter and fighter-bomber fleets were given a camouflage colour scheme (a lesson learned from the Six-Day War – see next chapter), even the flying colleges gave their aircraft the new paint job. Therefore, the MiG-21PF, MiG-21PFS MiG-21PFM interceptors, MiG-21Rs, MiG-21S fighters and MiG-21U, MiG-21US and MiG-21UM trainers exchanged the overall silver finish for a three-tone or four-tone green or green/brown camouflage pattern uncharacteristic for many of them. It is worth mentioning here that MiG-21s in combat units had two-digit red or blue (seldom yellow) tactical codes – or low-visibility white outline codes. Those operated by Air Force flying colleges had three-digit side numbers (often white or yellow), as many prototype aircraft had. This made it easy to guess which type of unit operated them.

Sergey Popsuyevich

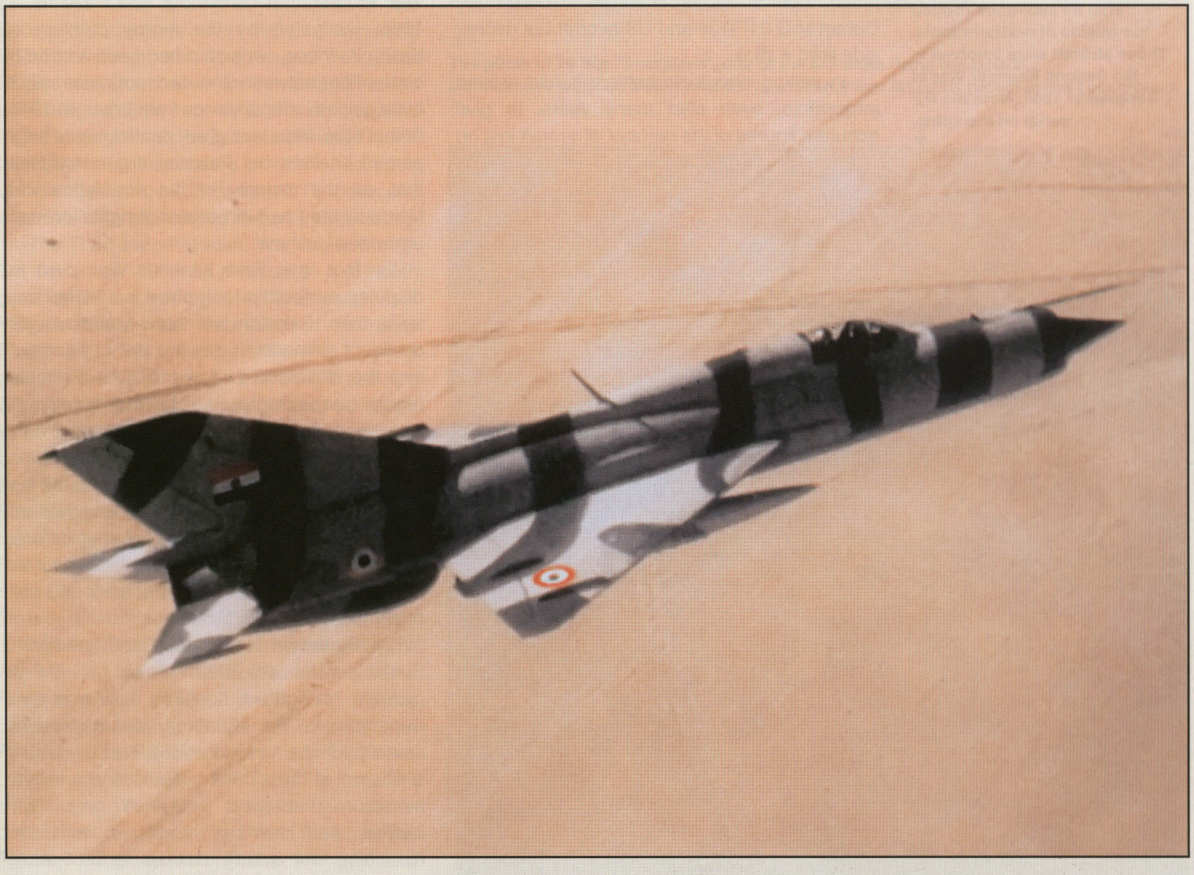
Known Soviet and Russian MiG-21s are listed below. Because of the Soviet/Russian system of tactical codes, the list is in c/n order, sorted by version. Please note that, although the MiG-21 was operated by the Soviet Air Force in large numbers, unfortunately very few aircraft have been positively identified because researchers/spotters had no access to the MiG-21s in the years when the type was in first-line service (this also applies to the MiG-21 units stationed outside the USSR) due to strict security measures. The records of MiG-21s withdrawn from service are either still classified or no longer exist.

C/n	Line no.	Version	Tactical code	Comments
N63210103		Ye-2A	not known	Operated by LII
N63210104		Ye-2A	no code	Ground instructional airframe at Air Force Academy (VVA), Moscow
65310108		MiG-21	not known	Converted to, see next line
		MiG-21F		Mikoyan OKB, Ye-6/2 (second prototype MiG-21F)
N72210101		MiG-21F	no code	Mikoyan OKB, first production example
N72210206		MiG-21F	01 Red?	GK NII VVS
N72210207		MiG-21F	02 Red?	GK NII VVS
N72210301		MiG-21F	31 Red	Mikoyan OKB, Ye-6T/1
N72210302		MiG-21F	32 Red	Mikoyan OKB, Ye-6T/2
N72210602		MiG-21F	01 Red	Preserved Central Armed Forces Museum, Moscow
N74210104		MiG-21F-13	01 Red	Modified, Mikoyan OKB
N74210301		Ye-6V/2	no code	Mikoyan OKB
N74210313		MiG-21F-13	21 Yellow	Preserved Khar'kov
N74210803		MiG-21F-13	45 Yellow	Preserved Mytishchi, Moscow Region
N74210809		MiG-21F-13	not known	
N74211410		MiG-21F-13	97 Blue	Kubinka AB
N76210101		MiG-21PF	no code	First production example, R11F2-300 engine, special colour scheme
N76210103		MiG-21PF	no code	Mikoyan OKB, development aircraft (Ye-7SPS prototype, later Ye-7M); reported as coded '22 Red'
N76210703		MiG-21PF	no code	Mikoyan OKB, testbed for K-51 weapons system
N76210725		MiG-21PF	none	Mikoyan OKB, development aircraft with large vertical tail
N76210820		MiG-21PF	02 Red	Mikoyan OKB
N76210825		Ye-7R	78 Red	Prototype, Mikoyan OKB. Converted MiG-21PF
N76211325		MiG-21PF	not known	Wings later on composite aircraft with MiG-21S fuselage preserved in Moscow city as '07 Red'
N76211615		MiG-21PF	not known	First example with K-51 weapons system
N76212106		MiG-21PF	not known	See next line
N76212110		MiG-21PF	95 Yellow	Preserved Lietuvos Aviacijos Muzieju, Kaunas; c/n also reported as N76212106
N76212122		MiG-21PF	16 Red	Preserved Moscow-Khodynka
N76212318		MiG-21PF	98 Red	Preserved Moscow-Khodynka
940101		MiG-21PFS	not known	First production example; one-piece canopy, SK-1 ejection seat and narrow-chord vertical tail
940724		Ye-7R	not known	Prototype, Mikoyan OKB; converted MiG-21PFM
940735		Ye-7R	not known	Prototype, Mikoyan OKB; converted MiG-21PFM
940912		MiG-21PFS	not known	First with KT-102 wheels, better brakes and 500x180A tyres
941001		MiG-21PFS	not known	First MiG-21PFS with large vertical tail
941221		MiG-21PFS	not known	First MiG-21PFS with new SK-3 (KM-1) ejection seat and two-piece canopy
941314		MiG-21PFS	not known	All production MiG-21PFSs with this and higher c/ns fitted with SK-3 (KM-1) ejection seats etc
N94210425		MiG-21PFS	09 Blue	Preserved Great Patriotic War Museum, Moscow (later as 09 Red)
N94210810		MiG-21PFS	14 Blue	Preserved Valeriy P. Chkalov Museum, Chkalovsk
N94210818		MiG-21PFS	not known	Last production aircraft to receive the MiG-21PFS designation
N94210819		MiG-21PFM	not known	First a/c to be given MiG-21PFM designation as perdocuments even though it was not up to full spec
N94211014		MiG-21PFS	57 White outline	Stored Dolgoye Ledovo, Moscow Region
940ACh17	1717	MiG-21PFS	45 Red outline	Converted to M-21 target drone. Preserved Ukrainian National Aviation Museum, Kiev-Zhulyany
940AK14	1914	MiG-21PFS	49 Red	Ground instructional airframe at Ukrainian National Aviation University, Kiev-Zhulyany
940MS01	2001	MiG-21PFM	not known	First production MiG-21PFM
940MS13	2013	MiG-21PFM	21 Red	Preserved Twenthe, Belgium; later Militaire Luchtvaart Museum (Soesterberg, Holland) as '45 Red'
940 MO 12	2312	MiG-21PFM	227 White outline	Barnaul Military Pilot College (BVVAUL); previous code unknown
940 OM 24	3224	MiG-21PFM	27 Red	Preserved Liepaja, Latvia
030101		MiG-21R	not known	First production example
030AT22	1622	MiG-21R	30 Red	Preserved Moscow-Khodynka

N95210101		MiG-21S	not known	Mikoyan OKB, first prototype
N95210102		MiG-21S	92 Red	Mikoyan OKB, second prototype. Preserved Central Russian Air Force Museum, Monino, as '93 Red'
N950SCh13	0713	MiG-21S	not known	
N950 SI 13	0813	MiG-21S	20 Red?	
150 SO 01	0301	MiG-21SM	35 White outline	Preserved Vytautas Lapenas Aviation Museum, Istros, Lithuania
150 ** 15	...715?	MiG-21SM	31	Preserved Magadan city; c/n reported as 150Ya15 which is impossible (probably 150*Ch15)
964411		MiG-21MF	?? Blue	234th GvIAP
96011804		MiG-21MF	71 Blue	Ground instructional airframe Samara State Aviation University; also reported as MiG-21M c/n 961804
964011		MiG-21MT	11 Blue	Preserved Dolgoye Ledovo, Moscow Region
964014		MiG-21MT	14 White outline	Preserved Dolgoye Ledovo
964015		MiG-21MT	15 Blue	Ground instructional airframe Dolgoye Ledovo
500AT01	1601	MiG-21SMT	11 Yellow	Preserved Arboga, Sweden
500AT15	1615	MiG-21SMT	no code	Preserved Moscow-Khodynka
500ACh02	1702	MiG-21SMT	17 Red?	Preserved as gate guard Lyubotin near Khar'kov?
50019005?	?	MiG-21SMT	11 Red	Preserved Victory Park, Saratov, Russia; c/n also reported as 50014005
50019105	?	MiG-21SMT	52 Yellow	Preserved Kissimmee, Florida
50022121	?	MiG-21SMT	60 Red	Preserved Altenburg (Nöbitz), formerly 01 Red and 24 Red
50023098	2119?	MiG-21SMT	09 Yellow	Preserved Lodderköppinge, later Landskrona, now Ugglarp, Sweden
50023100	2120	MiG-21SMT	10 Yellow	Preserved Latvian Aviation & Technical Museum, Riga-Skulte
50027021	2304	MiG-21SMT	76 Yellow	Converted MiG-21SMT. Preserved Latvian Aviation & Technical Museum, Riga-Skulte
50029107	23...	MiG-21SMT	42 Yellow	Derelict Riga-Skulte
50029804?	2317	MiG-21SMT	40 Yellow	Converted MiG-21SMT. C/n also reported as 50029084. Pres. Latvian Aviation & Technical Museum
75001105	?	MiG-21-93	21-93 Blue	RSK MiG. Converted MiG-21*bis* Fishbed-N; previous code unknown
75002198	?	MiG-21*bis*	01 Red	Mikoyan OKB, surge prevention system testbed; preserved Kiev Air Force Institute
75009521	?	MiG-21*bis*	Russian AF '351'	RSK MiG. Converted MiG-21*bis* Fishbed-N; previous code unknown
75011394		MiG-21*bis*	35 Blue	
75014699		MiG-21*bis*	45 Red	515th IAP
75014947		MiG-21*bis*	53 Red	515th IAP
75021148	?	MiG-21*bis*	48 Blue	Polyot-OI system (*Fishbed-N*). Preserved Central Russian Air Force Museum, Monino
75021730		MiG-21*bis*	17 Red	To Ukrainian AF
75027008		MiG-21*bis*	07	
75029617		MiG-21*bis*	61 White outline	
75041927?		MiG-21*bis*	01 Blue	To Ukrainian AF
75053824		MiG-21*bis*	08 Red	515th IAP
75091147		MiG-21*bis*	08 Blue	NAZ Sokol demonstrator
75092823		MiG-21*bis*	not known	
N010103		MiG-21I	no code	Preserved Central Russian Air Force Museum, Monino
N010104		MiG-21I	CCCP A-144	Crashed Zhukovskiy 28-6-70
09685126		MiG-21US	68 White outline	Testbed. Preserved at Test Pilots School, Zhukovskiy
04685127		MiG-21US	106 Yellow	BVVAUL; previous code unknown
02685133		MiG-21US	06 Red	Preserved Latvian Aviation Museum, Riga-Skulte
02685150		MiG-21US	Soviet/Russian AF76 White	BVVAUL; previous code unknown
06685162		MiG-21US	66 Blue	Based Kubinka AB?
08695162		MiG-21UM	Soviet/Russian AF '62 White outline'	Based Zhukovskiy
06695169		MiG-21UM	82 Red	515th IAP
516909026		MiG-21UM	Soviet/Russian AF '68 White outline'	Based Zhukovskiy
516931061		MiG-21UM	Soviet/Russian AF '61'	Based Zhukovskiy
516939011		MiG-21UM	94 Yellow	Preserved Latvian Aviation & Technical Museum, Riga-Skulte
516943046		MiG-21UM	Soviet/Russian AF '30 Blue'	Based Zhukovskiy
516963056		MiG-21UM	Soviet/Russian AF '204 White'	BVVAUL; previous code unknown
516972055		MiG-21UM	Soviet/Russian AF '210 White outline'	BVVAUL; previous code unknown
516977095		MiG-21UM	10 Blue	GNIKI VVS; has GNIKI VVS badge on nose
516985011		MiG-21UM	Soviet/Russian AF '206 White'	BVVAUL; previous code unknown
516987051		MiG-21UM	300 White	BVVAUL; previous code unknown
516999054		MiG-21UM	not known	Preserved Wright-Patterson AFB
516999362		MiG-21UM	Soviet/Russian AF '200 White'	BVVAUL; previous code unknown

PART NINE

MiG-21 AT WAR



Since it entered service in 1959, there have been few, if any, wars in which the MiG-21 has not been involved. In 1961 the 32nd GvIAP PVO at Kubinka AB became the first unit in the USSR to become operational on the type. As recounted in the preceding chapter, one year later, its move to Cuba (under its new designation of 213th IAP PVO) very nearly sparked off World War 3.

In spite of other contributing factors, there is no denying the fact that, until the resolution of the Cuban Missile Crisis on 28th October 1962, war between the USSR and the USA and its allies was a hair's breadth away. Fortunately for the human race, John F. Kennedy and Nikita S. Khrushchov hammered out a compromise, full details of which were not made public at the time but which ultimately led to Khrushchov's downfall for apparently being too lenient with the other side. Even as the negotiations were taking place, confrontations occurred between the Cuban MiG-21F-13s and US aircraft but neither side fired a shot.

In writing about air battles, it has proved impossible, even after many years, to give accurate figures of the number of aircraft lost on either side. Claims have become legends and both sides often find cogent reasons for persuading themselves that their figures are correct. In effect, this is an apology for not being able to give accurate losses in the battles described below. Determining the cause of a loss is even more difficult, as some pilots are reluctant to admit to being shot down by another aircraft, seeing it as a slur on their proficiency.

This book is devoted solely to the exploits of MiG-21s so the reader is warned in advance that the tallies of losses and victories given below do not pretend to give a full picture of the battles described. Due to lack of space, we cannot give a blow-by-blow account or show in detail the interaction between the MiG-21 and other aircraft and defensive systems.

Indian Air Force/28 Squadron MiG-21F-13 BC821 and a sister ship fly above the rugged mountains of northern India. These aircraft were involved in the Second Kashmir War of September 1965. Note the IFF aerial on the spine. ▼

via Pushpindar Singh

Wars between India and Pakistan

War erupted between India and Pakistan in 1965, instigated by the thorny problem of Kashmir whose ownership had been a bone of contention between the two countries since India gained independence from Britain in 1947. At that time, India was given control over a large part of Kashmir but Pakistan argued strongly that, as the majority of the population was Moslem, they had proprietorial rights over an undivided Kashmir.

In fact, the First Kashmir War over its disputed ownership took place in 1947-48 and since then, Pakistan has actively encouraged dissident elements. It was this encouragement, and the infiltration in April 1965 by Pakistani regular troops disguised as locals in an attempt to foment an uprising in Indian Kashmir and Jammu, that induced the Second Kashmir War in the following September. Fighting lasted five weeks, only ending when the United Nations mandated a ceasefire. In spite of considerable air activity on both sides, very little involved MiG-21 fighters that, at the time, equipped only one Indian Air Force (IAF) squadron.

28 Squadron was formed at Chandigarh, Punjab, in January 1963 with six MiG-21F-13 (*izdeliye* 74) fighters, adopting the name 'First Supersonics'. The squadron was manned by seven pilots trained in the USSR. In December 1963 two of the aircraft collided and crashed. Incredibly, the pilots sustained only slight injuries and training continued with the remaining four aircraft until Spring 1965 when another MiG-21F-13 was lost in an accident. Reinforcements in the form of four more MiG-21F-13s plus two MiG-21PFs (*izdeliye* 76A) and more pilots arrived in March 1965; thus, by the outbreak of the war with Pakistan in

September 1965, 28 Sqn had nine MiG-21s but its pilots could not claim to be fully familiar with both types. Nonetheless, they flew to Adampur, eager for glory. Their first mission was on 4th September 1965 when they provided top cover for Dassault Mystère IV fighter-bombers attacking Pakistani tanks with close support from HAL Ajeet fighters. Neither side gained victories that day and surprisingly, nor were any losses sustained when the MiGs dived to attack Pakistani Air Force (PAF) North American F-86 Sabres which were attempting to interrupt the ground attackers. The Indian pilots were justifiably upset by the poor performance of their R-3S air-to-air missiles.

By 6th September the squadron had moved to Pathankot AB, Himachal Pradesh, to join 23 Squadron and other units based there. That same day, with no combat air patrol protecting the airfield, it was successfully attacked by four Sabres that destroyed two MiG-21s (including BC827) on the ground. As a result of the losses, 28 Sqn was stood down for the duration of the war. Despite some reports to the contrary, no MiG-21s fought with Pakistani Lockheed F-104A Starfighters (at least some of which had been donated by the Royal Jordanian Air Force) or any other PAF aircraft after the raid on Pathankot.

The Third Indo-Pakistani War broke out on 3rd December 1971 as a result of the Indian government supporting the break-away East Pakistan State, which had adopted the name Bangladesh. This time, the IAF's MiG-21 pilots had fully mastered their new MiG-21FL (*izdeliye* 77) interceptors, many of which were equipped with a GP-9 gun pack. Eight squadrons were fully operational: 1 Sqn 'Tigers', 4 Sqn 'Oorials', 8 Sqn 'Pursoots', 28 Sqn 'First Supersonics', 29 Sqn 'Scorpions', 30 Sqn 'Charging Rhinos', 45 Sqn 'Flying Daggers' and 47 Sqn 'Black Archers'. Five of these units were oriented towards the main PAF force to the west and three faced east towards what was to become Bangladesh.

Although 3rd December 1971 was the day the war officially started, the border between East Pakistan and India had long since become a battleground. After an East Pakistan Parliament General Election, in which the Awami League won 167 out of 169 seats, its President could claim the right to form the overall government of both East and West Pakistan. The Pakistani Prime Minister rejected this right, and after a General Strike in East Pakistan, followed on 3rd March 1971 by a mutiny of Bengali elements of the Pakistani Army, martial law was declared in East Pakistan. In the meantime, three loyal divisions had been flown in to sort out the rebels.

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The pilots of 29 Sqn 'Scorpions', one of the IAF units flying the MiG-21.
Maintenance work on an IAF MiG-21FL, with an 8 Sqn MiG-21U (U460) in the background.
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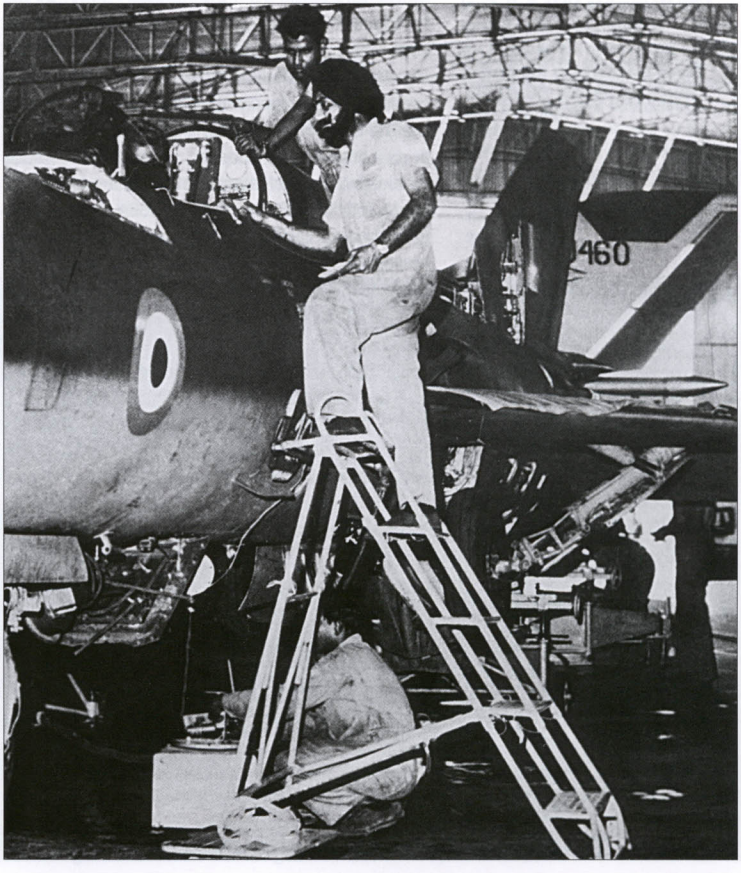

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Flt. Lt. Bharat Bhushan Soni of 47 Squadron and his MiG-21FL. On 12th December 1971 B. B. Soni gained the distinction of shooting down a Pakistani Air Force F-104A over the Gulf of Kutch during the Third Indo-Pakistani War.

Wg. Cdr. Mervyn E. Middlecoat of 9 Squadron who flew the F-104A shot down by B. B. Soni.
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On 26th March, East Pakistan declared itself the independent state of Bangladesh and many its supporters came from the Pakistan army. By the middle of June, the rebellion had been crushed but with such ferocity and cruelty that, aided and abetted by the Indian Army, another rebel force arose – this time receiving more overt support from the Indian Army, whose artillery joined the fray by firing across the border. Further desertions weakened the Pakistani army and the Indian Air Force intervened to stop PAF F-86s attacking the rebel troops. By November, it was reported that 6 million refugees had fled from East Pakistan into India (some sources suggest well over 10 million refugees by the start of the war) and both sides were massing troops on the Western Frontier of India. After India had rejected Pakistan's suggestion that both sides withdraw their troops from the East Pakistan border, the Pakistani leaders decided on a pre-emptive strike. In this way it was hoped that, after international pressure had stopped the war, any territorial gains in the West could be traded off against the inevitable losses in the East. During the early evening of 3rd December 1971, Pakistani aircraft attacked ten IAF bases in two waves with night interdiction to follow. The damage done was not excessive, as Pakistan had deployed less than one-third of its total strike force, presumably in an effort to minimise losses. The IAF was able to counter-attack in force early the following day.

On the Eastern Front, airborne hostilities had been launched on 22nd November 1971 when four Pakistani F-86Fs attacked the Indian Boyra Salient that Bangladeshi Mukti Bahini guerrillas were using as a safe haven from which to attack the Pakistan army. Four Indian Ajeets attacked, later claiming the shooting down of three F-86s. The PAF, although fighting valiantly, was dramatically outnumbered and overwhelmed within a few days of the official start of the war. This was inevitable, given that the PAF had only No.14 Sqn with 19 Sabres (of which only eight could carry AIM-9B Sidewinder missiles), which was pitched against 28 and 30 Sqns flying MiG-21FLs and another seven units flying Ajeets and Hawker Hunter F.56s. On 4th December four 28 Sqn MiG-21FLs led by the unit's CO Flt. Lt. Bhupinder Kumar Bishnoi attacked Tezgaon AB near Dhaka, cratering the runways; MiG-21FL C1111 flown by Flt. Lt. Manbir Singh shot down an F-86 with two R-3S missiles. All activity of the PAF on the Eastern Front ceased on 5th December; subsequently 13 aircraft were destroyed by their owners to stop them from falling into enemy hands. On 14th December, 28 Sqn delivered the *coup de grâce* when four MiGs (again led by B. K. Bishnoi) attacked the building where Dr. Malek, Governor of East Pakistan, was having a Cabinet meeting. Unguided rockets smashed through the windows, traumatising all inside. This attack was the straw that broke that camel's back, resulting in the breakdown of civil administration and the surrender of the Pakistani Army on the Eastern Front on 16th December 1971. Subsequently international recognition of the new state of Bangladesh was quickly given.

On the Western Front Nos 1, 29, 45 and 47 Squadrons had received MiG-21FL fighters and, when not escorting Sukhoi Su-7BMK or HAL

HF-24 Marut fighter-bombers, tried to lure the enemy into the open with armed reconnaissance raids. The strategy was only partially successful as the Northern sector displayed very little in the way of aerial activity, but the squadrons in the Southern Sector had better luck.

On 12th December a pair of 9 Sqn PAF F-104As from Masroor AB came in at low level over the Gulf of Kutch and strafed Jamnagar AB, Gujarat. However, they had been spotted in timely fashion, and two 47 Sqn MiG-21FLs on quick-reaction alert scrambled to intercept. The Pakistani wingman turned away on seeing the interceptors, but the lead Starfighter flown by Wg. Cdr. Mervyn E. Middlecoat passed over the runway and was fired upon by the base's air defence guns, which missed. MiG-21FL C750 piloted by Flt. Lt. Bharat Bhushan Soni latched onto the Starfighter's tail and fired an R-3S missile. However, the F-104 launched IRCM flares, decoying the missile, and pressed on towards the sea, trying to get away. Luckily, C750 was the only one of the six resident MiG-21FLs to be fitted with a GP-9 cannon pod. Closing in on his quarry, B. B. Soni fired a burst from his cannon at about 300 m (980 ft) range; the Starfighter immediately burst into flames and the pilot ejected over the sea. In spite of an intensive search, there was no trace of Wg. Cdr. Middlecoat and he is still listed as missing in action. His chances of survival were very slim, as the Gulf of Kutch is thick with sharks.

Two more 9 Sqn Starfighters were shot down that same day by Sqn. Ldr. Iqbal Singh Bindra and Flt. Lt. Niraj Kukreja of 29 Sqn flying top cover for Marut fighter-bombers which were attacked over Umarkot. On 16th December Flt. Lt. Samar Bikram Shah in a 29 Sqn MiG-21FL, also on escort duty, shot down an attacking Shenyang F-6.

On 13th December two pairs of 47 Sqn MiG-21FLs piloted by Sqn. Ldr. Vinay Kapila (leader of the strike pair), Wg. Cdr. Harcharan Singh 'High Speed' Gill (wingman), Flt. Lt. I. S. Boparai (leader of the escort pair) and Flt. Lt. B. B. Soni (wingman) attempted to attack the Badin air defence radar complex in Southern Sind which was vital for the Pakistanis. The target area was obscured by a heavy sand storm, making it difficult to keep formation. Adding offense to injury, the MiGs were fired upon by anti-aircraft artillery. The fighters broke away from the target, as the chances of locating the radar site were close to nil. As they did, MiG-21FL C705 flown by Wg. Cdr. Gill was hit by AAA; the fighter hit the

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◄ **Flt. Lt. Bhupinder Kumar Bishnoi, the CO of 28 Squadron 'First Supersonics' during the 1971 Indo-Pakistani war. He went on to become Air Vice Marshal.**

The MiG-21FL played a crucial role in the 1971 war. The aircraft sported different camouflage schemes, as illustrated by C731, C746 and C1111, all belonging to 28 Sqn. The latter aircraft shot down an F-86F with two AAMs on 4th December 1971. ▼

via RART

ground and exploded at 1615 hrs, killing the pilot.

The air battle on this front was interesting because, although the IAF enjoyed numerical superiority, it was the PAF that had the technological advantage. Its AIM-9B air-to-air missiles were vastly superior to the R-13 and the recently installed US ground radar surveillance system was capable of tracking low flying aircraft and was far more effective than the manned observation posts of the IAF. The discrepancy in air strength is less pronounced once account is taken of the fact that PAF squadrons contained up to 20% more aeroplanes than those of the IAF and that the figures do not include all the aircraft donated by Jordan.

The IAF suffered six combat losses of MiG-21FLs, mostly to AAA. On 5th December Flt. Lt. Harish Singhji of 29 Sqn flying C764 was shot down near Suleimanke and captured by the Pakistanis. On 6th December Sqn. Ldr. Dopey Rao of 4 Sqn had to eject near Gauhati when his aircraft ran out of fuel after being damaged by AAA. On 8th December Sqn. Ldr. Denzil Joseph Keelor of 45 Sqn had to eject after being shot down near Chamb. On 11th December Flt. Lt. Ashok Balwant Dhavle of 1 Sqn in C1107 was shot down and killed at Adampur by another MiG-21FL whose pilot mistook his aircraft for a PAF jet. On 12th December Sqn. Ldr. P. S. Gill (the brother of H. S. Gill) in C603 was shot down near Agartala but survived. On 17th December Flt. Lt. Tejwant Singh of 29 Sqn in C716 was shot down near Pasroor by Flt. Lt. Maqsood Amir of 18 Sqn PAF in an F-86F and taken prisoner.

Much has been written on the subject of 'Who won the Air War?', but what was the truth? As an example of contradicting claims, the Pakistan Air Force at first claimed to have downed 100 IAF aircraft for the loss of 36 while the Indian Air Force accepted a loss of only 42 against the destruction of 86 PAF aircraft. Later, the PAF admitted the loss of 29 on the ground, including the 13 destroyed by their own troops in East Pakistan. It is highly unlikely that the truth will ever be known. The authors believe that about 20 combat aircraft were lost by each side in air battles, that over twice as many Indian aircraft were lost to ground fire as Pakistani (say 16 to 36) and that the IAF losses on the ground were minimal, one or two at the most, compared with Pakistan's admitted 29.

These conclusions tot up to 65 Pakistani and 58 Indian losses but the PAF will point out that 13 of their losses were self-inflicted and the IAF that most of theirs were from ground fire while supporting their victorious troops and so on...

The day after the battle had ended in East Pakistan the Indian government declared a unilateral ceasefire with which Pakistan immediately concurred. The Indian objective on the Western Front had been to retain terrain rather than to destroy the Pakistan Army. At the time of the ceasefire India was occupying about 13,000 km2 (5,019 sq. miles) of Pakistan territory. As a goodwill gesture in the Simla Agreement of 1972, Indian forces withdrew from most of this land.

The Atlantic Affair

On 10th August 1999, Sqn. Ldr. Prashant Kumar Bundela of 45 Sqn IAF flying a MiG-21*bis* from Naliya AB shot down a Pakistani Navy/29 Sqn Bréguet 1150 Atlantic 1 anti-submarine warfare aircraft serialled PN 91 (c/n 33) with a Matra R550 AAM in the Kutch Region. The IAF claimed that the aircraft had crossed the border, refused to accept instructions when challenged and behaved aggressively. The Pakistan Navy's argument was that the Atlantic was on a training flight and over Pakistani territory when shot down. Whoever was right, 16 people had lost their lives. The action caused an international scandal and the Pakistan government claimed compensation from India at the International Court of Justice in The Hague but lost the case.

IPKF

After the assault of the Sri Lankan Army in 1987 had successfully wrested control of Jaffna from the Tamil Tiger rebels (LTTE – Liberation Tigers of Tamil Eelam), the Indian Press portrayed the attack as unnecessarily brutal and claiming too many civilian lives. The Indian government, mindful of its own large Tamil population and ever-increasing number of refugees from Sri Lanka, brokered a ceasefire agreement between the hostile groups in return for a federal structure for that country. It was conditional on all rebels laying down their arms and India agreed to send a Peace Keeping Force (IPKF) to monitor the ceasefire. After initially agreeing to it, the LTTE refused to hand in their arms and soon found its members themselves fighting the Indian Army.

After some initial successes, the Indian Army failed to subdue completely the LTTE which had waged a guerrilla campaign against them. Reports indicated that Indian Air Force MiG-21s were used to support the army but no further details are available. The Sri Lankan population objected to a foreign army on their island, and on 28th September 1989 the Indian Army started to withdraw. The last soldiers left for home in March 1990.

via Detlev Grass

▲ **North Vietnamese Air Force MiG-21F-13s, with a MiG-21U in the middle of the flight line.**

Sri Lankan Civil War

Since the 1970s, the Tamils in the North of Sri Lanka have tried to form a separate state using armed rebellion to achieve their aims. One of the several groups involved in the struggle was the LTTE. In the early 1980s it successfully fought other less militant Tamil groups. When India brokered a ceasefire agreement with the Sri Lankan government in 1987 on the promise of a Federal Tamil State, LTTE originally accepted the terms but then reneged on the agreement and fought the Indian Army which was monitoring the agreement. This phase lasted until 1990 when the Sri Lankan government requested the Indian Army to withdraw and took over the struggle itself.

To add to the SLAF armoury, four Chengdu F-7BS fighters and one Guizhou FT-7BS trainer were delivered in 1991 to 5 Jet Squadron at Katunayake AB. Unfortunately, there was a shortage of trained pilots to fly them, so they were used temporarily for training until the Spring offensive in April 1995 when they were used to attack LTTE positions in the successful assault and capture of Batticaloa. The arrival of IAI Kfir C2 fighter-bombers in 1996 created a further shortage of pilots – a problem solved in March by mothballing the F-7BS and FT-7BS fleet. The situation eased as more pilots were trained but the F-7BSs were subsequently used only for conversion training as more Kfirs and a few MiG-27M ground attack aircraft were delivered by the end of 2000. While on a training flight on 23rd July 2000, F-7BS CF704 unaccountably went out of control on landing and was destroyed in the crash; happily the pilot ejected safely.

Vietnam

French Indochina was created when, from a base in Cochin-China, first Cambodia and then Laos were acquired, followed in 1884-85 by Vietnam and finally, in 1900, Kwang-Chou-Wan. This situation continued until 1942 when Japanese troops conquered the country, only to be ousted in 1945 at the end of World War 2. At this point, Indochina reverted to French rule but independence movements for self-rule sprang up, generating first guerrilla wars and finally, full-scale battles, which culminated in French defeat at the Battle of Dien Bien Phu in 1954. Afterwards the French withdrew from the area. Vietnam was split at the 49th Parallel into the Communist North Vietnam (supported by the USSR) and the free market South Vietnam (backed by the USA). There were elements in both North and South who wanted to create a unified communist Vietnam. The communist guerrilla army in the South, known as the Viet Cong, was strongly supported by the North and it was not long before a full-blown war between the two Vietnams developed. The USA not only supplied weapons but by 1956, US Army advisors had taken over the training of the South's army and the US role escalated into full-scale warfare. In 1963, 16,000 American soldiers were involved in this strange and bloody war; by 1968 the total had risen to 550,000 notwithstanding that, as a result of international pressure, US engagement was limited in the amount and type of force they could use.

Soviet support for North Vietnam took the form of significant quantities of arms and aircraft. On 3rd February 1964 the first fighter regiment (FR, or *Trung doan*) was formed as 921 FR *Sao Do*, having flown from China where its personnel had been in training with their MiG-17s. A second fighter regiment, 923 FR *Yen Bai*, was formed on 7th September 1964. Until the arrival of twenty new MiG-21F-13s in late 1965, the North Vietnamese Air Force (NVAF) had deployed MiG-17 and MiG-19S fighters; most of the new aircraft were given to the experienced 921 FR based at Noi Bai, but others were trusted to select pilots who had received some training on the type in the USSR. Pilots not allocated to the MiG-21F-13s were given conversion training on UTI MiG-15s, and later Shenyang JJ-5s (a

Chinese two-seat development of the MiG-17), in the absence, at that time, of MiG-21Us. All pilots honed their skills attacking US Ryan BQM-34 Firebee reconnaissance drones. In fact, no drones had been destroyed until Nguyen Hong Nhi was successful on 4th March 1966.

It is important to emphasise that this section does not attempt to give a balanced view of the air war between the American and North Vietnamese; it tries only to consider how the MiG-21 fighters fared in that conflict and recognises that this task is complicated by MiG-17 and MiG-19 involvement. The NVAF was tasked with defending North Vietnamese airspace against American attacks and until the US left it rarely strayed into South Vietnam, whereas the US aircraft roamed freely over the South, supporting action against the Viet Cong and in particular trying to stop the military supplies feeding down the Ho Chi Minh Trail. The American involvement was huge, and it is important to note that the attacks on North Vietnam were just a part of it.

The first engagement of a MiG-21F-13 with a manned aircraft took place on 23rd April 1966 with McDonnell F-4 Phantom IIs in which neither side scored a kill. The learning curve for the young North Vietnamese pilots was steep, as evidenced by the several who ran out of fuel and had to eject. Their first combat loss was on 26th April when a MiG-21F-13 was shot down by a McDonnell F-4C and their maiden success was thought to have been a Republic F-105 Thunderchief on 6th June 1966 but US loss records fail to confirm it. Rules of engagement, as determined by HQ in Hanoi, were rigid; planes could only be scrambled by the central command and in flights of two pairs. In other words, closely controlled combat was the order of the day, rather than allow the MiG-21 to operate in the interceptor role. The North Vietnamese claimed the destruction of two F-4s on 9th June; although no losses caused by MiGs appear in US records for this day, the claim cannot be ruled out as it is often difficult to determine whether the loss was caused by missiles fired from the ground or from an aircraft.

During 1966, 30 MiG-21PFL (*izdeliye* 76) interceptors were supplied to 921 FR *Sao Do* to make good the losses and expand the regiment; this variant had an improved radar system but no cannon. Nonetheless, the lack of success caused a fortuitous change of tactics: MiG-17 undertook combat air patrol at low altitudes (less than 1,500 m/4,920.ft) and the accompanying MiG-21 would fly higher (above 2,000 m/6,560.ft). The intention was that the nimble MiG-17s, which possessed an advantage over the F-4 at low altitude, would force the Phantoms to climb in order to try a diving attack – and then be engaged by the waiting MiG-21s.

Several claims of kills were registered but ironically, the first loss to a MiG-21 admitted by the Americans, an F-4C on 5th October, was not claimed by any MiG-21 pilot. During 1966, six North Vietnamese MiG-21s were lost according to US claims and 18 US aircraft were claimed shot down (seven F-4s and 11 F-105s); American sources admit to four losses at the hands of MiG-21s but many of the other claims were losses attributed to different causes. There were also instances of US losses attributed to MiG-21s but not claimed by Vietnamese pilots. There are suggestions that fighter pilots commonly believed it to be less humiliating to be shot down from ground fire rather than by another pilot but when your aircraft is hit by a missile fired by an unseen aircraft at several kilometres distance, it is difficult, if not impossible, to be certain of the cause.

By far the greatest North Vietnamese losses in a single engagement since the outbreak of war were on 2nd January 1967 when Col. Robin Olds led the 8th TFW's F-4Cs into battle above Noi Bai

MiG-21PFMs on the flight line at a Vietnamese airbase, with a MiG-21F-13 in between. The nearest aircraft, '5015 Red', has had crude green mottle camouflage applied on site. ▼

via Detlev Grass

and five MiG-21s were shot down, mostly picked off just after taking off. Another two MiG-21s were destroyed by F-4Cs four days later and 921 FR was withdrawn from action for a few months to regroup and recover confidence. These losses galvanised HQ into another change of tactics, which aimed at positioning the MiG-21s so that they could swoop down on the enemy, fly through them and reposition themselves for another diving attack; dogfighting was to be left to the more nimble MiG-17s.

Furthermore, Russian advice was accepted and, instead of being confined to operations around their own airfield, MiG-21s now strove to attack while the enemy planes were still in a tight formation on their way to the intended target.

The 921 FR *Sao Do* was back in action by April and lost an aircraft on the 23rd to an F-4C. On the 28th an F-105D's loss was attributed to MiG-21 action but no claim was made. May was a frantic month as air attacks on Hanoi recommenceded and another MiG-21 fell to Col. Olds but the F-105F shot down on 12th was recorded as lost to SAMs. Between 23rd April and 10th August the MiG-21s claimed 12 kills for the loss of six and this impressive performance inspired HQ to order larger formations of fighters into battle; with only one regiment of MiG-21s available it was necessary not to be profligate with such limited resources. July, August and September saw a reduction in US attacks, with reconnaissance flights forming their main activity. One departure from this plan of action was a raid by 40 American fighter-bombers, two of which were shot down by 921 FR fighters. October saw a resumption of sustained aggression and in November 921 FR *Sao Do* were instructed to keep an aircraft in the air at all times, this dictate presumably applying only to daylight hours. The year ended with some determined engagements and Vu Ngoc Nhi became an ace.

In 1967, the North Vietnamese MiG-21 pilots claimed to have shot down 17 F-105s, 11 F-4s, two McDonnell RF-101C Voodoos, one each of the Douglas A-4 Skyhawk, Vought F-8 Crusader and Douglas EB-66C Destroyer plus three unidentified types. There is a large discrepancy between this total of 36 and the 10 admitted by the Americans; of course, the usual rationale applies with all its exemptions and denials. Similar provisos apply to the US statement of 21 MiG-21s destroyed.

1968 came in with a flourish, helped by the arrival of 29 more MiG-21 pilots, fresh from their training in the USSR. Four F-105s were claimed in January, along with an EB-66C – a loss admitted by the USAF – and two F-4s. February was less active, with only three claims, and March passed even more sedately with only one EB-66 supposedly shot down but for which there was no corresponding US loss acknowledged. Records for May and June show an F-4 downed in each month, one of which was Nguyen Van Coc's seventh victim. On the other side, two MiG-21s were lost during an attack on US Navy warships and a USN F-8H claimed a MiG-21. July saw no Vietnamese claims; conversely, F-4Js from the USS *Intrepid* succeeded in shooting down a MiG-21 on the 10th. On 1st August, Nguyen Hong Nhi was credited with an F-8 but another shot him down after his missile firing mechanism failed; he ejected safely and returned to his unit after three days in the jungle. On 19th September there was another unsubstantiated claim for an F-8 and also one from the USN for bringing down a MiG-21. A Firebee reconnaissance drone was destroyed by Nguyen Dan Kinh on 21st September.

A halt on all bombing was declared by the US authorities on 1st October followed by a ban on all overflights of North Vietnam apart from reconnaissance missions; in the meantime, bombing of suitable targets in Laos and South Vietnam continued. 921 FR MiG-21s had a quieter time but managed to shoot down an F-4 on 26th October. In the last two months of 1968 there were no victories for either side; the total for the year stood at 17 Vietnamese claims (five admitted to be by MiG-21s) and nine American, of which five were admitted. During 1968, 921 FR had received substantial numbers of MiG-21PFMs (*izdeliye* 94) capable of carrying the GP-9 gun pod, by which time, the surviving MiG-21F-13 were no longer on active duty.

As cessation of bombing on North Vietnam survived into 1969, the NVAF began to receive

via RART

▲ **NVAF MiG-21 pilots share their impressions after a sortie.**

via RART

▶ **Nguyen Van Coc, the top-scoring Vietnamese ace flying the MiG-21, with nine 'kills' to his credit and a chestful of decorations.**

MiG-21MF (*izdeliye* 96F) fighters and 921 FR embarked on conversion training. A detachment of MiG-21MFs, together with a few MiG-17s, was transferred to Vinh and Anh Son with the intention of intercepting US aircraft en route to and from Laos. On 9th February, two MiG-21MFs flying to Ninh were jumped by American fighters and forced off course, whereby one ran out of fuel and crashed; fortunately, the pilot ejected safely. After intensive extra training on night and bad weather flying the detachment at Anh Son was declared operational on 6th April 1969. A setback occurred on 22nd April when reconnaissance drones spotted the MiG-21s, with the inevitable consequence that two fighters were destroyed by bombing. Neither was the rest of that year any more profitable for MiG-21 pilots, the only successes occurring when the ace pilot Nguyen Van Coc wrote off two Firebee drones in December against the three MiG-21s lost.

Two US aircraft were claimed by North Vietnam in January 1970 – a Sikorsky HH-53B helicopter that was searching over Laos for the crew of an F-105G and an F-4, the latter not being listed in US losses. It was, however, the final moment for Pham Dinh Tuan who had shot down the helicopter; he was killed when his aeroplane struck a mountainside in bad weather as he came in to land after the interception. Another Vietnamese combat loss happened over Ninh Binh on 28th March when a missile launched by a US Navy F-4J scored a direct hit on a MiG-21.

In the autumn of 1971, the North Vietnamese determined an ingenious strategy aimed at attacking the Boeing B-52 Stratofortresses that were bombing the supply lines. Examination and interpretation of the emerging patterns of B-52 contrails in the skies above Ba Don and Vinh Linh, led them to send three MiG-21s in the indicated direction of Dong Hoi to search for them. Vu Dinh Rang was the first Vietnamese pilot to intercept a B-52 on 20th November; he took off from Anh Son at 20.46 hrs and, approaching within 8 km (5 miles) of his first target, he fired a missile and on turning away, fired his last missile at a second B-52. He later learned that the first bomber had been damaged and was forced to make an emergency landing in Thailand.

Towards the end of 1971, President Richard Nixon warned the Hanoi government that, unless the North Vietnamese troops refrained from moving south, he would reinstate bombing strikes. When it became necessary to implement the threat, two F-4Ds were shot down on 18th December 1972. The scene was set for the grand finale.

Now fully converted to the MiG-21MF, the 921 FR was given a second site at Chuong My to accommodate a back-up force, thus reinforcing the regiment in air battles as required and to defend the main base from attack. When the North Vietnamese Army tried secretly to reinforce its troops in the south in preparation for a spring offensive, the Americans, on detecting the intention, responded with intensive bombing of targets in South Vietnam. In anticipation of more raids, a second MiG-21 regiment, 927 FR *Lam Son*, was formed on 3rd February 1972. Based at Noi Bai in North Vietnam, the new regiment flew MiG-21PFM (*izdeliye* 94A) fighters and opened operations with 24 pilots. The hiatus of the past two years had given the Americans time to reconsider their tactics and build up resources. The effort paid dividends and, in the first four months of 1972, they shot down seven MiG-21s without loss; the 432nd TFW was particularly effective, claiming six of the kills. One example of their predetermined strategies that was particularly effective was that which instructed the F-4s to avoid fights in the vertical plane. Another was to extend the standard separation between two aircraft to 900 m (2,950 ft) to obtain a better look-out and finally, when attacked, to refrain from attempting to out-turn a MiG-21 at medium or high altitudes but rather to dive as low as possible where the F-4 could excel.

On 16th April 1972 the Americans fought a major air battle against ten MiG-21s, six MiG-19s and 14 MiG-17s that were trying to protect the supply lines near the 20th Parallel; in this battle three MiG-21s were lost. The first NVAF success of the year was on 27th April when two MiG-21MFs of 921 FS attacked two USN F-4Bs and shot one down. However, the Americans tasted revenge just over a week later when two MiG-21s were destroyed by F-4Js of VF-114. Another loss for 927 FR was on 8th May when Vo Si Giap was hit and, in spite of being ordered to eject, he heroically stayed with his aircraft to avoid a school. On turning his aircraft it exploded and he was killed but the school was saved.

In response to the Spring Offensive (also known as the Tet Offensive) that the North Vietnamese Army launched on 30th March 1972, the Americans began, on 10th May, the *Linebacker 1* bombing campaign during which any target in Vietnam – North or South – could be hit. At this time the MiG-21s were distributed between Anh Son, Hoa Lac, Yen Bai and Kep but the Anh Son detachment were soon moved to Mieu Mon; the 45th Radar Company supported the 921 FR and the 43rd Radar Company supported the 927 FR. A little later, the 23rd Radar Company was sent to reinforce the assistance to both regiments.

An air battle on 10th May sprang from the shooting down of a MiG-21MF from 921 FR by F-4Es from 432nd TFW; in retaliation, an F-4E was destroyed by a missile fired by Dang Ngoc Ngu. In another dogfight, two MiG-21MFs attacked six F-4Es and one Phantom II was shot down before its victor was killed by 'friendly fire' from a Vietnamese SAM unit; the second attacking MiG was hit by cannon fire but escaped to land safely at Noi Bai. Meanwhile, 927 FR had been launched and scored its first success by downing two USN F-4Js whose crews were convinced that their nemesis had come from ground fire. This series of dogfights ended when an F-4J claimed another MiG-21. To sum up the losses on 10th May: MiG-21s claimed 4 and lost 3 – the Americans shot down two and one was lost to friendly fire; as before, the US losses were ascribed to ground fire.

To improve their results, the NVAF devised a split defence: one so-called attack group patrolled at 1,200 km/h (745 mph) at 300-800 m (980-2,625 ft). at a distance of 10-15 km (6.2-9.3 miles) from the target while above them lurked a deception group at 900 km/h (559 mph) and at

MiG-21PFL '4326 Red' adorned with 13 'kill' stars shares the ramp with a MiG-21PFM. ▼

via Detlev Grass

8,000 to 10,000 ft (26,250-32,810 ft). Ground radar stations controlled both groups.

On 11th May, when 26 USAF aircraft attacked Bâc Mai airfield, 927 FR had already sent up two pairs of MiGs on patrol. It was not long before the attack group encountered an F-105G, which was destroyed by the wingman; shortly afterward the flight leader intercepted the escorting four F-4Ds and shot one down before his aircraft was hit by a missile but he ejected safely.

A pair of MiG-21PFMs was part of a mixed fighter force that engaged the enemy over Kep on 18th May and it was then that Nguyen Hong Nhi claimed his eighth and last victim. Two days later two MiG-21MFs of 921 FR valiantly attacked 12 F-4Ds, destroying one. Both regiments were scrambled on 23rd May with each side laying claim to a victory and Nguyen Duc Soat, now with the 927 FR, attacked and claimed a Vought A-7B Corsair II whose pilot reported he was hit by ground fire. There was substantial activity in the following week with neither side winning any trophies. During this time the US Navy did admit the loss of an F-8J that could have been attributed to a MiG-21 but the NVAF made no acknowledgement of it. On 31st May the US reported that it had shot down two MiG-21s.

Having limited numbers of aircraft and experienced pilots, NVAF HQ staff became increasingly perturbed by their losses. They had ample grounds for unease, as their quixotic pilots regularly and intrepidly attacked formations six times their own strength.

Whatever pep talks were given to the regimental COs at the HQ meetings, June was a more fruitful month for the NVAF. American claims only amounted to two MiG-21s but 921 and 927 FRs, both now flying MiG-21MFs, together claimed seven F-4s verified by USAF records plus seven unverified victories.

27th June was a particularly successful day for the NVAF when the USAF sent 44 aircraft into the Hanoi area and lost three to MiG-21MFs, with another two claimed but not verified, and this against no MiG-21 losses.

Success brings its own problems and the NVAF became concerned that some pilots were becoming over-confident, even contemptuous, of the enemy – a trait which, if allowed to continue, would inevitably lead to disaster. Commanders were briefed to watch out for these attitudes and deal with them severely and were also encouraged to analyse losses carefully instead of trying to extract immediate vengeance.

5th July proved to be another successful day for the NVAF when two 927 FR pilots each destroyed an F-4E. On 8th July Dang Ngoc Ngu of 921 FR shot down his seventh and last victim but three MiG-21s were lost on the same day, two to the same 432nd TFW F-4E. A USN F-4J was lost on 10th July without any NVAF claim. But on the 18th July 432nd TFW struck again and another 921FR MiG-21 and its pilot were lost.

July came to an end with numerous aerial battles: 927 FR claimed four F-4s on 28th but only one was verified by US records, another verified F-4E on the 29th and yet another Phantom, an F-4D, on the 30th. Two MiG-21s were claimed by USAF on 29th July.

August 1972 was a bad month for NVAF MiG-21s, with only one F-4E shot down by 927 FR's Nguyen Duc Soat on 30th against five American successes between the 10th and 28th. September's yield was no better with two acknowledged claims for 927 FR on the 11th and 12th, against five claimed MiG-21 fighters by the USAF and a MiG-21US trainer by the US Navy.

Events went from bad to worse in October for the MiG-21s, with eight American claims against three verified losses of F-4Es but a brief respite was heralded by President Nixon on the 22nd when he announced the suspension of bombing raids on North Vietnam territory. During the hiatus that followed, three Firebee reconnaissance drones were destroyed but it did not last long as Operation *Linebacker II* began on 17th December. Not only were B-52s to attack Hanoi but General Dynamics F-111 Aardvarks were devolved to join them in the bombing of numerous airfields with low level attacks while F-105G Wild Weasels destroyed SAM sites and radar stations; over 100 F-4s would be launched to protect them.

B-52 bombers were a sharp thorn in the side of the North Vietnamese, and the only fighter in service that could climb high enough to attack them was the MiG-21. Therefore, a special effort was made and twelve pilots were selected and given special training in their interception. In view of the MiG-21's short range, it would be necessary to have recourse to emergency landing strips and, although no time was lost in implementing an intensive training scheme, familiarising eight pilots with their use and practising night interceptions, none of the eight was proficient enough for this duty until nearly the end of the year.

The rear gunner of a B-52 claimed a MiG-21 on 18th December and on the same day; another MiG-21 was lost to an F-4E. Retribution followed swiftly, with fighters of 921 FR claiming four F-4s in the same week, none of which the Americans credited to MiG-21 activity. The US 432nd TFW squadron took the credit for shooting down a

MiG-21 on both the 21st and 22nd December and the rear gunner of a B-52 was confident that he had eliminated another on Christmas Eve. On the 27th two F-4Es were shot down by 921 FR plus another claimed but not acknowledged. But what had to be acknowledged that fateful day was the first destruction of a B-52. There is no doubt about its demise but the USAF insisted that it was occasioned by a surface-to-air missile. The NVAF reckoned the B-52 was destroyed by two air-to-air missiles fired at a range of 2 km (1.24 miles) at an altitude 10,000 m (32,810 ft) by Pham Tuan of 921 FR; he had been guided to the bombers by Moc Chau and Son La ground control stations. Pham Tuan was operating out of Noi Bai and he landed at Yen Bai after the incident to refuel before returning to his home base. Noi Bai as well as Kep, Gia Lam, Hoa Lac and Yen Bai had been subjected to intensive bombing for nearly two weeks; yet all except Kep and Noi Bai remained operational, although badly damaged, and the other three were effectively put out of action. Anticipating an imminent intensification of US bombing raids, the NVAF had built a new airbase at Can Thuy and providentially evacuated both MiG-21 regiments there on 26th December, just one day before Bai Lai, Yen Bai and Gia Lam again took a severe pounding. On the same day, there was the confirmed destruction of two F-4Es and a claim by the NVAF for a third. Two MiG-21s were shot down on the 28th December, one by 432nd TFW and the other by VF-142, however, a USN North American RA-5C Vigilante was lost to a missile fired by a 921 FR pilot and another B-52 exploded. Vu Xuan Thieu, guided by Tho Xuan airbase's GCI system, had stalked the bomber's trail but was too close when he fired his missiles and his MiG-21MF crashed quite close to the bomber's remains. Once again, the USAF claimed that an SAM had destroyed the B-52.

Linebacker II succeeded in its main objective of bring the North Vietnamese back to the conference table before its suspension on 30th December 1972. The last MiG-21 casualty of the American involvement was inflicted by 432nd TFW on 7th January 1973. The Paris Peace Accord, which was signed on 27th January 1973, recognised North Vietnam as a sovereign state and agreed that the USA would cease all military action against it and also withdraw all its forces from South Vietnam. Nonetheless, the United States did all it could within the treaty requirements to help South Vietnam to survive as an independent state.

During 1972, the US claimed to have destroyed 78 NVAF fighters, of which there were 51 MiG-21s, 11 MiG-19s and 16 MiG-17s, and accepted that 25 of their own had been lost to MiG-21 activity. They refused, however, to cede to the NVAF approximately 28 additional MiG-21 victories, attributing their loss to other causes, notably SAMs.

via RART

▲ **Vietnamese MiG-21 pilots walk back to the briefing room after a mission.**

Soviet General Fesenko, senior advisor to the NVAF, recorded the following fighter activity for 1972:

- 823 fighter missions, 540 with MiG-21s, 76 with MiG-19s, 207 with MiG-17s;
- 89 US aircraft destroyed in 201 combats;
- 52 NVAF fighters were lost, of which there were 34 MiG-21s, 9 MiG-19s and 9 MiG-17s.

It is difficult to draw conclusions from the above data, except that every country will, either accidentally or deliberately, end up by claiming greater victories than their antagonist admit as losses.

The withdrawal of the USA from active military participation did not stop their supplying South Vietnam with the appliances of war in anticipation of a renewed battle for total control of the country. For their part, North Vietnam sought and received similar assistance from the USSR and took the opportunity before the next phase of the struggle to reorganise their resources. By January 1974 921 FR *Sao Do* at Noi Bai was charged with defending Supply Routes 1 and 3 near Hanoi and, where necessary, placing detachments at Vinh and Dong Hoi. 927 FR *Lam Son* was tasked with defending the area east of Hanoi and to be prepared to move to Tho Xuan if the need arose. Recognising that the failure to stop the B-52 bombing campaign was due to lack of pilots skilled in night and IMC flying, 42 MiG-21 pilots were sent to the USSR for training to remedy this deficiency in early 1974 and another tranche underwent similar preparation at home.

The North Vietnamese government decided to invade South Vietnam to support the National

North Vietnamese Air Force MiG-21 Aces:		
Pilot	**Regiment**	**Number of Claimed Victories**
Nguyen Van Coc	921 FR *Sao Do*	9
Pham Thanh Ngan	921 FR *Sao Do*	8
Nguyen Hong Nhi	921 FR *Sao Do* then 927 FR *Lam Son*	8
Mai Van Cuong	921 FR *Sao Do*	8
Dang Ngoc Ngu	921 FR *Sao Do*	7
Vu Ngoc Dinh	921 FR *Sao Do*	6
Nguyen Ngoc Do	921 FR *Sao Do*	6
Nguyen Nhat Chieu	921 FR *Sao Do*	6
Le Than Dao	927 FR *Lam Son*	6
Nguyen Dang Kinh	921 FR *Sao Do*	6
Nguyen Duc Soat	921 FR *Sao Do* then 927 FR *Lam Son*	6
Nguyen Tiem Sam	921 FR *Sao Do* then 927 FR *Lam Son*	6
Nguyen Van Nghia	927 FR *Lam Son*	5

Front for the Liberation of Vietnam (more commonly known as the Viet Cong), and with that in mind, transferred 927 FR to Noi Bai prior to the start of the major offensive on 4th March 1975. As airfields in South Vietnam were overrun, MiG-21MF units moved onto them to give close support to the infantry. South Vietnamese Air Force aircraft attacked the new bases but no details of battles with MiG-21MFs have been released. Hué fell on the 29th and by 30th April 1975 the war was over. Vietnam was now a united country, albeit a communist one.

For more details the reader is recommended to *MiG-21 Units of the Vietnam War* by István Toperczer, published by Osprey 2001, and also www.acig.org/artman/publish/cat_index_17.shtml

Vietnam's War with China

China invaded Vietnam on 17th February 1979 with 80,000 troops and 200 tanks. The hostilities did not have the aim of conquering the country but rather to inflict a military defeat and then magnanimously withdraw. The aggressors had successfully accomplished a similar campaign in India. China regarded the Khmer Rouge in Cambodia (Kampuchea) as allies and was infuriated by Vietnam's invasion and occupation of the country. The Chinese Army, having advanced 40 km (24.8 miles) into Vietnam and occupied the city of Lang Son together with a few other provincial capitals, declared the way to Hanoi was open and proceeded to withdraw its troops, a task completed by 16th March 1979. The whole campaign lasted less than a month and both sides proclaimed a victory. Chinese hardware had been unreliable since the Cultural Revolution, a factor which severely limited the number of operational tanks and aircraft.

The Vietnamese had needed to use only one regiment of the regular army plus some border troops and local militia to restrain the Chinese; the main army was in a defensive arc to defend Hanoi and furthermore, they had no need to withdraw troops from Cambodia. No references have been found of aircraft activity in the campaign but it beggars belief to think that they were not used. Vietnam was likely to have used the MiG-21MF and Northrop F-5A and the PLAAF the Shenyang J-6 and possibly the Chengdu J-7 I. The latter type was not considered to be very reliable, although it was used by the PLAAF during the Vietnam War and had shot down six US combat aircraft intruding Chinese airspace between 1969 and 1971.

Vietnam's Invasion of Cambodia (Kampuchea)

Cambodia was part of French Indochina until 9th November 1953, when it became an independent constitutional monarchy under King Norodom Sihanouk. In 1955 he abdicated to become an elected prime minister. His father succeeded him as King and remained on the throne until his death in 1960 when Sihanouk became Head of the State, calling himself a Prince. While on a trip abroad in 1970, there was a military *coup d'état* by the then Prime Minister Lon Nol but Sihanouk threw in his lot with the Khmer Rouge communist guerrillas, and a civil war ensued. Lon Nol professed a neutral policy over the Vietnam War, although actually backing the USA, but the Khmer Rouge supported North Vietnam. The Americans invaded Cambodia for a short time to attack Viet Cong camps there and used B-52s to carpet-bomb them. The rebellion spread, initiating the USAF's bombing of Khmer Rouge sites, which continued until 1973; the bombing alienated the local people, increasing support for the rebels. The Khmer Rouge seized the capital on 17th April 1975, changing the name of the country to Democratic Kampuchea. By this time the Americans had left Vietnam which was now a socialist state. There were areas at the frontier between Vietnam and Cambodia to which both countries laid claim and on 1st May 1975 Kampuchean commandos raided Phu Quoc Island without any bloodshed. In another raid, this time on Tho Chu Island, there was fierce fighting, after which the commandos took back into Kampuchea 515 hostages who were later executed.

The Khmer Rouge undertook a ruthless purge of all considered enemies of the state, including many of Vietnamese origin. The Kampuchean government found close allies in

China who helped form a new Air Force by donating 16 Shenyang F-6C fighters. As a result of having such a strong ally, Kampuchea became bolder and increasingly persistent in its pursuit of more territory, leading Vietnam to send a flight of MiG-21MFs to Pakse airbase in Laos on 25th February 1976 for a deterrent bombing attack on Sieam Reap in Kampuchea. Undismayed, the Khmers attacked border posts in the proximity of Tien Thuan and in 1977, several regiments crossed the border into Svay Rieng province where they were bombed by a group of Vietnamese People's Air Force strike aircraft, which included MiG-21MFs.

The situation went from bad to worse after two divisions of Khmer troops probed into Ba Thuc on 14th April 1978, killing 2,500 people and deporting 20,000 Khmer Kroeum civilians back to Kampuchea. The worst flooding in the Mekong Delta for 100 years delayed any Vietnamese response but on 27th December 1978, 200,000 Vietnamese troops invaded Kampuchea. Air support was provided by the 901st Air Group, which at first comprised only former South Vietnamese Air Force aircraft. For ground attack the Northrop F-5A Freedom Fighter was preferred to the MiG-21 because it had longer range and carried a heavier war load. However, after two weeks of fighting, a squadron of MiG-21MFs arrived and was hurriedly armed with unguided rockets or 500-kg (1,102-lb) bombs for ground attack raids.

Vietnamese progress was swift and its troops occupied most of the large towns by the end of March 1979. Although the Khmer Rouge was defeated, it was not destroyed and held out in several areas throughout the 1980s. With Vietnamese help, a new Kampuchean Air Force was created in 1984, using Soviet-built helicopters and transport aircraft, but it was not until 1988 that the 701st Fighter Regiment was formed. Pilots and ground staff were trained at Bien Hoa AB in Vietnam to use the 24 MiG-21*bis* fighters and a single MiG-21UM trainer that had arrived from the USSR. The regiment was declared operational in 1989, by which time peace talks had started in Paris. A peace accord was finally signed in October 1991 with the United Nations enforcing the ceasefire.

Civil Wars in Laos

Laos was part of the Siamese Empire until 1893 when it became part of French Indochina; in 1950 it was granted the position of an 'Associate State in the French Union'. This forty-nine-year period was, of course, interrupted by the three-year occupation by Japan in 1942-45. In 1954, Laos gained independence as a constitutional monarchy but a communist guerrilla movement, Pathet Lao (Land of Laos), slowly grew until it challenged the government in a civil war. The monarchy was supported by the USA, which became embroiled in the 1960s in the war between the communist North and free market South Vietnam. The North needed a supply route linking it with Yunnan Province in China and the so-called 'Chinese Trail', navigable to lorries, was built through the jungle by Chinese sappers. Thailand, worried about its possible and likely extension towards its border, joined forces with the Royal Laos Army to stop it. By 1971, there were 25,000 Chinese troops in Laos in addition to the Pathet Lao guerrilla army and a major confrontation was in sight, especially as the US was using Special Forces and giving air support to the royalists. President Nixon personally negotiated a deal with the Chinese government in 1972 whereby the Trail would not be further extended. In return, the US promised to withdraw its support for attacks on the road.

The North Vietnamese Army had taken over areas of Laos adjacent to the Ho Chi Minh supply trail and, with the help of the Pathet Lao, fought off attempts to dislodge them. B-52s and US fighter-bombers tried to destroy communist camps but in early 1972 two North Vietnamese divisions attacked the Plain of Jars, with MiG-21MFs flying overhead primarily to protect the troops from attack by US aircraft.

An armistice was declared in Laos from 22nd January 1973 and American involvement in Vietnam ceased five days later. By 1975 the Pathet Lao was in full control of the country. King Savang Vatthana abdicated on 2nd December 1975 and the country was renamed Lao People's Democratic Republic. The new republic did not have to wait long before another war started. This time it was the Hmongs who revolted; during the Vietnam War they had sided with the Americans as the 'Secret Army' and helped to rescue many airmen. Help for the new Republic was received from Vietnam in the form of 40,000 troops and the air support given included MiG-21MFs and Northrop F-5As based at Pakse, from which airfield attacks were also made against Khmer Rouge targets in Cambodia. Most of the Hmong people fled to Thailand after the main force had been defeated but many were forcibly repatriated in the 1990s.

Myanmar (Burma)

Ever since Myanmar (then known as Burma) became independent of Britain in 1947, the country has been plagued with civil wars. Initially

the communists rebelled, followed by the Karens, and then Kuomintang refugees from China formed the National Salvation Army (NSA) with the ultimate intention of invading China. The NSA made two major attempts in 1950 and 1952 to cross the border into Yunnan Province but was defeated. The remnants of the NSA settled in the Golden Triangle (the border area adjoining Laos and Thailand) to produce and distribute opium. The NSA problem was finally solved with help from both China and the USA: the Chinese sent three divisions into the area and, jointly with the Burmese Army, crushed the NSA. Americans flew most of the survivors to Formosa (Taiwan) and Laos, the last leaving in January 1961. American help was freely given to attempt to stamp out opium production, which was subsequently controlled by local warlords.

The next concern was the Karen rebels who wanted to secede but it proved to be a long drawn out affair. In 1988, before the fracas could be settled, a military *coup d'état* took place, after which the country was run by the 'State Law and Restoration Council' of generals. The Myanmar government, as the country then became known, proceeded to deal ruthlessly with any opposition, particularly the Karen rebels who were forcefully repatriated away from the poppy fields. In addition to the Karens, other tribes such as the Akha, Kachin, Kayan, Kerreni, Labu, Mons, Naga, Shan, Srakan and Wa had also recruited their own armies. The most powerful drugs baron was General Khun Sa, who merited the title because he controlled an army of over 12,000 soldiers.

When the first tranche of Chengdu F-7M fighters and Guizhou FT-7 trainers arrived in 1990, the pilots were sent to China for training and the following year four 'squadrons' were allegedly operational and should have been operating in the many civil wars that were ongoing. Unfortunately there is no direct evidence of their participation – only records of complaints by the Myanmar authorities of their poor quality and high maintenance costs.

In 1992, the Thai authorities forced back over the border 60,000 Karens and 15,000 Mons who had taken refuge there; many accepted the offer of an amnesty for those who gave up their guns. This action seemed to have resolved the Karen problem for a time. General Khun Sa's army was then attacked in 1998 and soundly trounced but not destroyed, as his soldiers fled into the jungle after the General had surrendered. The Air Force was very active in this campaign, so it is highly probable that some attempt was made to use the F-7Ms.

Concerned that Border Post 9631 garrisoned by 20 Thai border guards was the gateway to drug traffic between Thailand and Myanmar, the Myanmar government sent in several hundred troops on 9th February 2001 to attack it. After holding out for four hours and killing 14 of the attackers, the 18 Thai soldiers that were left took their wounded with them and abandoned the post. On the following day, the Thais retook the post but, after the arrival of reinforcements, Myanmar troops recaptured it on 11th February – only to lose it yet again that evening, and this time it was final.

In the skirmishes, the Thai Air Force had been prominent, flying about 70 sorties using mostly Northrop F-5As. It was the intention of the Myanmar Air Force to use F-7Ms in the battle and it ordered the deployment of all three squadrons to Kengtung, the nearest airbase to the action. In fact, only six arrived but did not take part in the action, presumably because of mechanical problems. A cease-fire was agreed on the 12th February and the Myanmar Army continued to fight against the troops of the Shan State Army.

In spite of the problems experienced with the F-7Ms and FT-7s, an additional order for 12 was placed in 1993. Continued dissatisfaction with the reliability and maintenance costs of both types led to a contract being placed in 1997 with Elbit for the Israeli company to re-equip 36 fighters and trainers, including refitting of 12 new fighters from Chengdu. The new equipment included Elta EL/M-2032 interception radar, Rafael Litening laser designator pods and gave them the ability to fire Rafael Python 3 air-to-air missiles and drop laser-guided bombs. To reflect their improved ground attack ability, the modified fighters were redesignated F-7FGA.

The arrest of Shan leaders in February 2005 led, three months later, to another declaration of independence. Furthermore, the apparently successful agreement with the Karen National Union to stop fighting did not, in reality, lead to a ceasefire and sporadic fighting continues to this day. So the Myanmar Air Force has no doubt been kept busy.

Indonesia

After the unsuccessful communist coup against President Sukarno on 30th September 1965, there was a violent and bloody anti-communist purge of civilian and military communist sympathisers. Indonesia had the third largest communist party in the world and the number of people killed is estimated to be at least 500,000, large numbers of which were members of the armed forces. While details are not known it

would be surprising if the MiG-21F-13 fighters delivered in 1962 were not used to attack pockets of resistance in the many islands that constitute Indonesia.

Cuban overflight of the Dominican Republic

After the Cuban merchantman *Capitán Leo* had been arrested and taken into Puerto Plata for straying into the Dominican Republic's territorial waters en route to Angola, a squadron flight of MiG-21MFs overflew the port on 10th September 1977 to add weight to the Cuban demand for the vessel's release. This overflight was code-named Operation *Pico*. The Cubans threatened to bomb Puerto Plata and Santiago de los Caballeros if the Dominican government did not release the ship; after hurried negotiations the Dominicans agreed with the Cuban demands.

Cuban attack on a Bahamian Patrol Boat

On 10th May 1980 HMBS *Flamingo*, an off-shore patrol boat, arrested two Cuban fishing vessels named *Ferrocem 54* and *Ferrocem 165*, illegally plying their trade in the area of Cay Santo Domingo. While towing the boats into port, the ship was attacked at 17.50hrs by cannon fire from two Cuban Air Force MiG-21MFs. Two more aircraft returned an hour later and, in addition to cannon, fired unguided rockets at the ship. She was hit by rockets and the crew abandoned the sinking ship. While in the water, the survivors were subjected to cannon fire; four sailors were subsequently found to be missing, presumed dead.

The survivors, including the eight arrested Cuban fishermen, were picked up by the *Ferrocem 165* and taken to Ragged Island where the following morning the ship was aggressively buzzed by two MiG-21MFs, a helicopter and a transport aeroplane. As a DC-3 airliner carrying Bahamian officials made its final approach to land on the island, it had for a time, the helicopter on one wing tip and the transport on the other. By this time the fighters had left and were followed by the other aircraft two hours later.

The Cuban government later admitted the attack was a mistake and paid the Bahamian Government $10,000,000 in compensation.

Arab Fratricide – War between Egypt and Libya

Furious that Egypt's President Anwar al-Sadat had flown to Israel in 1977 to discuss terms for a détente, thousands of Libyan protesters instituted a 'March on Cairo' and the Libyan leader Colonel Muammar Gaddafi ordered an attack on Egyptian border posts. In response, an Egyptian armoured column headed for the frontier and on 21st July 1977 a group of Sukhoi Su-20 fighter-bombers escorted by MiG-21MFs bombed Libyan radar stations and army bases. Shortly afterwards, attacks were made by similar formations on airbases at Benghazi and al-Kurta; seven Libyan fighters were said to have been destroyed before they could take off. The inevitable response was an offensive on nearby Egyptian army positions.

The following day a second attack on Benghazi-Gamal Abdel Nasser AB found the Libyans better prepared and two Dassault Mirage 5DE fighters shot down one of the escorting MiG-21MFs. On the same day and repeated again the day after, the Libyan Arab Air Force engaged Egyptian targets and to their cost found MiG-21MFs waiting for them; three (some sources suggest four) Libyan Mirages and one MiG-23MS were shot down. Shortly afterwards a cease-fire was agreed. A popular uprising against the government in Egypt did not take place, much to Colonel Gaddafi's chagrin.

As is often the case with two armies facing one another, there were several examples of breakdowns in the ceasefire, the most significant taking place in 1979 when two MiG-23MSs had a dogfight with two Egyptian MiG-21MFs. However, the older MiG-21MFs had the advantage of carrying the latest US AIM-9P air-to-air missiles and Major Sal Mohammad shot down one MiG-23MS.

War between Chad and Libya

Colonel Gaddafi had long coveted Chad's Aozou Region, which adjoined Libya's southern border, and encouraged civil strife in that country, which had been independent since 11th August 1960. In 1977, Libya annexed the region and launched an invasion of Chad in 1979. French military support saved the Chad government in 1978 and 1983; there is no evidence of the use of MiG-21s by the Libyans in these conflicts as other types were considered more suitable for ground attack duties. The role adopted by the Libyans was to provide artillery, armoured vehicles and air support and use insurgent Chad forces, particularly the Transitional Government of National Unity (TGNU), as infantry. Between 1983 and 1986 French military intervention led Libyan and Chadian forces to face each other across the so-called Red Line (16th Parallel) but in 1986 the TGNU troops turned against their Libyan allies and forced them back into the Aozou Strip. Libyan air power gained their army a victory on

28th August 1983 and the lesson was learnt by the Chad leaders. An attack was launched on 5th September 1987 against Maaten-al-Sarra AB, 110 km (68 miles) inside Libya, by a force of about 2,000 Chadian commandos who took the Libyans by surprise, killing 1,713 of the 2,500-strong garrison. What equipment they could not take away they destroyed, accounting for 70 tanks, 30 armoured personnel carriers, 8 radar units, several SAM sites and 26 aircraft, including two MiG-21s, which were either MiG-21MFs or MiG-21*bis*. The jubilant Chadian troops, having achieved their purpose, then returned home. No other references to the use of MiG-21s in this war have been found. A ceasefire was agreed on 11th September 1987.

Arab-Israeli Conflicts

Prior to the end of the British Mandate on 15th May 1948, the Arab leaders rejected a United Nations plan to partition Palestine into Arab and Jewish states. On 14th May 1948 the Jewish leaders declared the formation of the independent state of Israel, a situation quickly recognised by the United States, Germany and many other countries but resented by all Moslem states. By the end of the month armies from Egypt, Syria, Iraq, Lebanon and Jordan had invaded Israel, whose armies repulsed the invasion. Between 23rd February and 9th July 1949 armistices were agreed and signed by Israel and all the warring Arab states, except Iraq, which had withdrawn its troops in March 1949 but refused to sign an armistice. The terms of the armistice gave Israel 18% of the territory mapped in the original British Mandate of Palestine; however, that amounted to 78% of the area excluding Jordan, which had already been awarded independence in 1946. The Gaza strip was allocated to Egypt and the West Bank to Jordan.

1956 saw an invasion of Egypt by Britain, France and Israel, which unsuccessfully challenged the nationalisation of the Suez Canal by President Nasser.

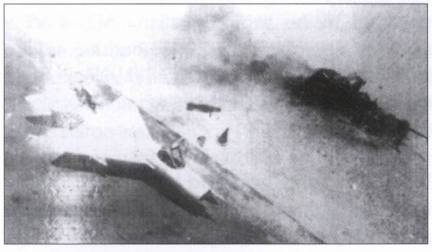
In 1967, the relations between Israel and its Arab neighbours worsened after Egypt compelled the United Nations Emergency Force to leave the Sinai Peninsula, blockaded the Straits of Tiran to Israeli ships and proposed unified Arab action against Israel. The Israeli response was a pre-emptive air strike on 5th June 1967 against first Egypt, then Syria and finally Iraq. The Six-Day War had begun.

The first wave of 170 Israeli Defence Force/Air Force (IDF/AF) fighter-bombers swept in at 07.45hrs from the direction of the sea well below the Egyptian radar screen, attacking ten airbases. For the loss of ten IDF/AF aircraft (four or five by MiG-21PFs), the claim was for 196 Egyptian planes destroyed on the ground and a further eight in air-to-air battles, of which seven were MiG-21s.

A second wave of about 100 aircraft swept in at 10.00hrs, again attacking ten airbases, claiming for the loss of one fighter, that 107 aircraft were destroyed on the ground and eight in the air (of which half were MiG-21s). The Egyptian losses occurred when a mixed force of 20 MiG-19s and MiG-21s from Hurghada on the Red Sea defended their airbase.

A third wave of 100 Israeli aircraft attacked ten airbases in Egypt, Syria, Iraq and Jordan, starting at 12.50hrs. For the loss of four of their own fighters, the Israelis claimed 61 Syrian, 30 Jordanian, 12 Iraqi and at least two Egyptian aircraft destroyed on the ground and 12 in air-to-air combat (including two Syrian and one Iraqi MiG-21s).

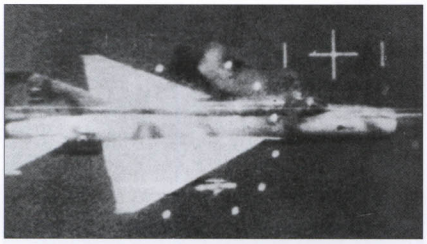
The fourth and last wave of over 50 Israeli fighter-bombers attacked five airbases in Egypt and Syria from 17.20hrs, claiming against a loss of two. About 12 Syrian fighters were destroyed on the ground, including a number of MiG-21s.

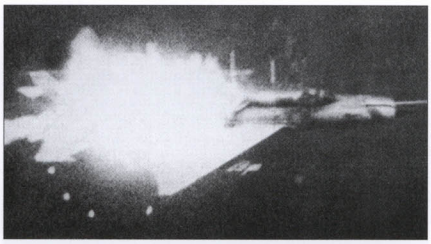


Post-strike reconnaissance by the Israeli Defence Force/Air Force. A seemingly intact but apparently unserviceable Egyptian Air Force MiG-21PF sits beside the smouldering wreckage of another aircraft.

The aftermath of the Six-Day War: the charred remains of Egyptian MiG-21s destroyed by an Israeli air raid.

All photos via RART





via RART

◄ **The end of an Egyptian MiG-21PFM captured by the gun camera of an IDF/AF Dassault Mirage IIICJ. Left, a puff of smoke appears aft of the cockpit as the Mirage's cannon shells hit the fuselage; next moment, the aircraft bursts into flames.**

The results were devastating for the Arabs. The Egyptian Air Force had received 235 MiG-21 fighters and 40 trainers; but in fact, losses in training and transfers to other Arab Air Forces had reduced that number to an estimated 102, according to Israeli sources (Arab sources suggest 108, a remarkably good agreement!). During this war the EAF lost, according to most well-informed sources, nearly 100 MiG-21 fighters, of which about 70 were destroyed while on the ground. Only 10 MiG-21s were left to fight another day.

Out of the total of 60 MiG-21F-13 and MiG-21PF fighters delivered to Syria, 35 were destroyed.

A truce was brokered on 11th June 1967 with Israel retaining most of its territorial gains, namely the Golan Heights and Sinai.

Thanks to the swift Soviet response to Egypt's and Syria's call for further supplies of military aircraft and SAM systems to replace their losses, their strengths were rapidly restored to pre-Six-Day War levels. Before the Arabs could undertake any offensive action against Israel, it was necessary for them to make good the losses of skilled pilots and to learn from their misguided tactics.

The MiG-21 pilots had been trained by the Soviets only in high-level interception manoeuvres and attacks but the Six-Day War had been fought at low altitudes and this, as well as other serious faults, had to be remedied. There could be no quick fix to this undertaking and it was evident that it would be several years before Egypt and Syria could take the offensive and attempt to regain their lost lands. While the MiG-17 carried a heavy cannon armament, the MiG-21s were deficient in this respect. The MiG-21F-13 had a single cannon with only 30 rounds; the MiG-21PF and early deliveries of the MiG-21PFM had no cannon at all and were dependent on the inaccurate and unreliable R-3S AAM. Fortunately for them, the missiles used by the IDF/AF were not much better, but all the Israeli fighters were equipped with cannons.

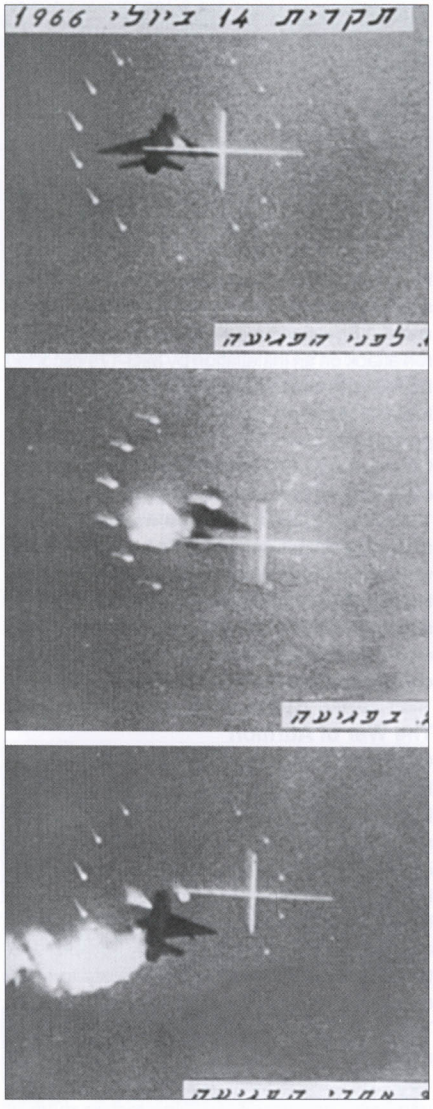
However, the ceasefire, while holding in principle, was broken by sporadic dogfights between aircraft as each side tested the strengths and reaction times of their adversaries and the Egyptians made the occasional hit-and-run attack on an installation by MiG-17s escorted by MiG-21s. For example, a camera-equipped MiG-21 (version unknown) was shot down by ground fire over el-Qantara on 8th July 1967. Offensive activity in the form of commando raids continued for the rest of the year. On 1st July 1968, the Egyptian Air Force was reorganised along Soviet lines and an Air Defence Command was split off, operating two brigades of interceptors plus SAM and radar sites. Pressure from the superpowers gave rise to a hiatus in 1968 broken on 8th September when Egyptian artillery fired on Israeli positions along the Suez Canal.

The War of Attrition

On 8th March 1969, President Gamal Abdel Nasser formally announced on the radio that Egypt was commencing a War of Attrition against Israel and Egyptian artillery lost no time in launching a massive bombardment of the Israeli Bar-Lev Line strung out along the East Bank of the Suez Canal. No full-scale Egyptian attack over the Nile took place; the intention was to make raids into Israeli held territory to inflict casualties even if their own losses were greater. The reasoning was that Israel with its smaller population could not tolerate huge losses. MiG-21s continued to escort MiG-17 fighter-bombers and succeeded in protecting them at some loss to themselves.

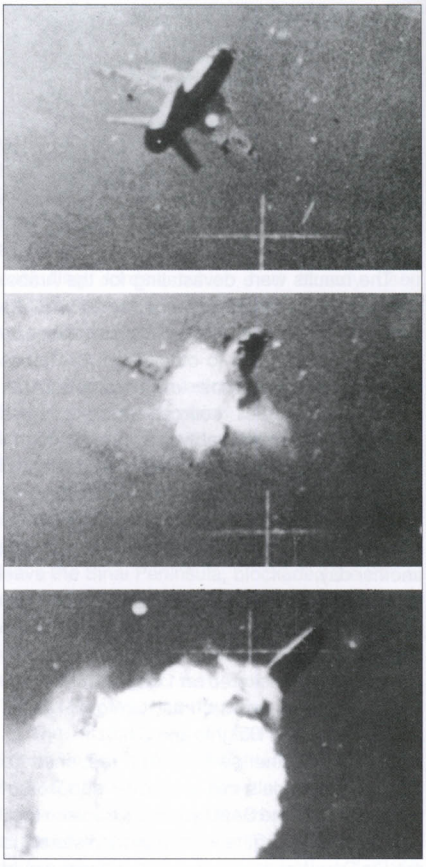
Between the end of the Six-Day War and the start of the War of Attrition, Israeli Mirage IIICJs shot down six confirmed EAF MiG-21s; in return, the EAF MiG-21s claimed two confirmed 'kills' and three probables. During the War of Attrition, Israel had 56 confirmed Egyptian MiG-21 victims and for their part, EAF MiG-21s claimed 14 confirmed victories and 12 possibles. Once again, it is important to remember that these figures represent only MiG-21 losses and do not reveal the whole picture.

The successes of the Israelis forced President Nasser to extend a plea to the Soviet government that Soviet pilots and SAM crews be



▶ **Gun camera imagery from an IDF/AF Mirage IIICJ confirming the destruction of an Egyptian MiG-21 in 1966. The MiG's engine is knocked out by a direct hit.**

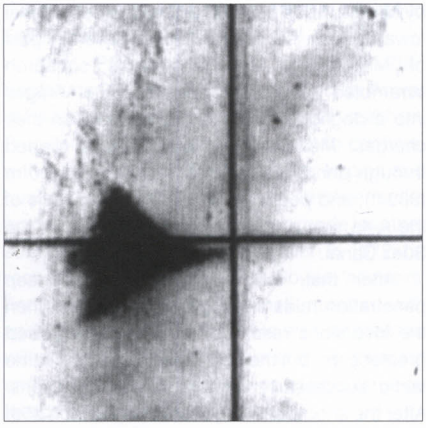
▶▶ **The last moments of another MiG-21 shot down by an IDF/AF Mirage IIICJ in 1967. Cannon shells puncture a fuel tank and the fightewr explodes violently in a huge fireball.**



These gun camera shots confirm the shootdown of a MiG-21 by an IDF/AF McDonnell Douglas F-4E Phantom II. ▼

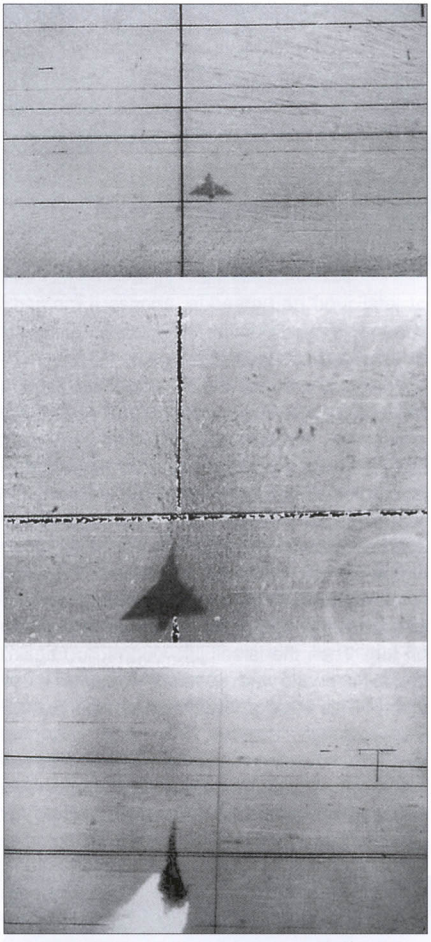
dispatched to Egypt in addition to the advisors and supplies of materiel. His wish was granted. The 135th IAP of the Soviet PVO, along with an independent fighter squadron (both flying MiG-21MFs painted in Egyptian insignia for appearance's sake), arrived in Egypt in June 1970 conjointly with three Brigades of the new S-125 (NATO SA-3) SAM batteries and ground radar stations with the intention of defending Egyptian cities against Israeli air attacks. All were manned by Soviet personnel, of whom there were now about 12,000 in Egypt; this mission was known in the USSR as Operation *Kavkaz* (Caucasus). The Soviet pilots were carefully selected for the mission – they had to have at least Pilot 2nd Class airmanship rating and several thousand hours' total flying time. Before

All photos via RART



departing on their tour of duty they took special training at a facility in Central Asia where the climatic conditions were as close to Egypt as you could get in the USSR. At first the instructors training the selected pilots were wont to capitalise on the strengths of the MiG-21MF and the perceived weaknesses of the Israeli jets, but the trainees did not buy this approach because enough objective information was available to tell them that the adversary was not to be treated lightly.

On arrival the Soviet pilots familiarised themselves with the area they were to defend. The 135th IAP commanded by Col. Konstantin Korotyuk covered the Egyptian territory south of the Helwan-Suez line; the independent fighter squadron commanded by Col. Yuriy Nastenko covered the Egyptian part of the Mediterranean and the area between Cairo, Alexandria and the Suez Canal, while Cairo itself was defended by Soviet and Egyptian SAM crews. The Soviet fighter units were stationed within 200 km (124 miles) of the Suez Canal, but the Soviet pilots were expressly forbidden to cross the canal.



◄
The encounters between the MiG-21 and Israeli jets were by no means a one-sided story. Sometimes the Israeli fighters pulled the short straw, as evidenced by the gun camera images of these Mirage IIICJs.
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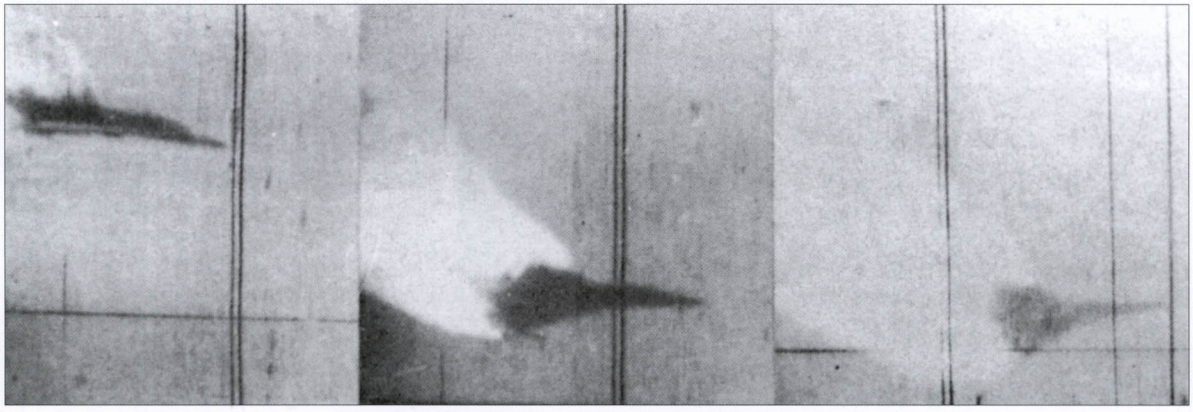
The Israeli intelligence service immediately became aware of the newly arrived reinforcements. Before long, the fact that Soviet fighter units were deployed in Egypt had made the headlines all over the world. The Soviet Union,



All photos via RART

▲ **An Egyptian Air Force MiG-21PFS serialled 8070. The fighter is camouflaged but, strangely enough, the canopy frame and the saddle tank are not – as if to tell the Israeli pilots where to aim.**

however, denied this fact, stating adamantly that it had sent only advisors to Egypt.

At first, the Soviet pilots' attempts to engage the Israelis were futile – the IDF/AF played cat and mouse with them. Crossing the Suez Canal, the Israeli jets would penetrate 30-40 km (18.6-24.8 miles) into Egypt; when the Soviet MiGs scrambled to intercept, the Israelis let them approach within 25-30 km (15-18.6 miles), then turned tail and retreated into Israel. The MiGs would chase them as far as the canal and return to base – they had to, as they were getting low on fuel. Then the Israeli jets popped up again, and the scenario was repeated – five or six times a day. This took a heavy toll on the human resources.

An Egyptian Air Force MiG-21RF serialled 8506 with a camera fairing aft of the nose gear unit. ▼

One more MiG-21RF, 8501, carrying a Type R ELINT pod and R-3S AAMs for self-defence. ▼▼

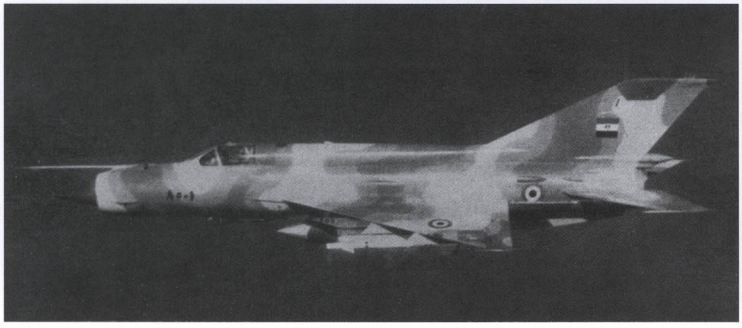
Soon, however, the Soviet pilots succeeded in foiling this game of tag. On 22nd June 1970 Egyptian air defence radars near Janaklis AB detected a group of A-4E attack aircraft escorted by Mirage IIICJs heading across the Suez Canal towards Ismailiya at low altitude. Several flights of MiG-21MFs from Nastenko's squadron scrambled immediately and lured the Mirages into a dogfight, forcing them to abandon their charges. Meanwhile, a pair of MiGs slipped through unnoticed to Ismailiya, flying at 100 m (330 ft), and pounced on the Skyhawks. One of the A-4s was shot down, crashing west of the Suez Canal.

After that, the IDF/AF halted the deep penetration raids into Egypt for a week. When the incursions resumed, the Israelis exercised greater care, but the Soviet pilots used the same tactic successfully on three more occasions. After the shootdown of yet another A-4E on 25th July, the Israelis decided to set a counter-trap. The plan involved 12 experienced IDF/AF pilots with a total of some 60 'kills' between them.

On 30th July 1970 a flight of four F-4E Phantom IIs crossed the Suez Canal, following the avenue of approach usually taken by the Skyhawks and keeping the same formation. Immediately eight Soviet-flown MiG-21MFs led by Capt. N. Kamenev took off and attacked, taking no precautions against a possible ambush. This was exactly what the Israelis were expecting and in a flash, two flights of four Mirage IIICJs that were lurking unseen over the Sinai Desert jumped them, destroying four of the MiGs for no loss to themselves (interestingly, the Egyptians claimed afterwards that *five* Soviet aircraft had been destroyed!). Phantom pilots Avihu Ben-Nun and Avie Stella shot down one aircraft each (with AIM-7 and AIM-9 missiles respectively), while the other two 'kills' were scored by Mirage pilots – Asher Smir, who downed a MiG with cannon fire, and an unidentified pilot who launched a Shafrir AAM. Three of the Soviet pilots (Capt. Zhuravlyov, Capt. Yurchenko and Capt. Yakovlev) were killed; the fourth pilot ejected and survived. Another pair of MiGs piloted by V. Kolosov and Yu. Pushkaryov scrambled to the rescue, but too late – the Israeli fighters had gone.

It was an embarrassing situation for the Soviets, who up to that point had had some success in drawing Israeli aircraft onto nests of SAMs. However, the S-125 SAM batteries persistently presented a very real problem to the Israelis, as their missiles could shoot down low-flying aircraft by diving down upon them.

Pressure again from the USA and USSR, both of whom were worried about possible escalation of the conflict, led to a ceasefire on 7th August 1970. The 21 IDF/AF aircraft destroyed by the Soviet fighter pilots and SAM crews were



All photos via RART

undoubtedly one of the factors that led Israel to sign the ceasefire agreement.

After President Nasser died on 28th September 1970 and was succeeded by Anwar al-Sadat, a peace agreement was reached. President Sadat wisely decided not to continue with the policy of attrition but rather, to plan and husband resources for a pre-emptive strike across the Nile in 1973. Sadat made another surprising but very popular decision in 1972; he requested the withdrawal of Soviet 'advisors' and pilots except for a small number with specialised technical skills. He was dissatisfied with the quality of the advisors and the standard and arrogance of their advice, particularly on tactics and training.

In the meantime, the struggle between Syria and Israel continued, though on a smaller scale than the Egyptian conflict. The Syrian Air Force (SyrAF) had replaced all its MiG-19s with MiG-21PFs and the former sent to Egypt. By 1969, the SyrAF had five squadrons with MiG-21F-13s and three with MiG-21PFs. Between the end of the Six-Day War and the end of the War of Attrition Israeli pilots claimed to have destroyed 25 Syrian MiG-21s and in their turn, Syrian MiG-21 pilots claimed three confirmed victories and four probables. In mid-September 1973, during the run-up to the Yom Kippur War, a furious air battle took place: two RF-4E reconnaissance aircraft escorted by two F-4Es, with four Mirage IIICJs lurking some distance behind, approached the Syrian coast and four MiG-21PFs took off from Abu al-Dahur to intercept. In the dogfight that followed, two MiG-21PFs and one Mirage IIICJ were shot down but a further four MiG-21s approaching the scene were bounced by four newly arrived Mirages and another two MiG-21s plunged to the ground, followed shortly by another MiG-21 and a Mirage. A Sikorsky CH-53D helicopter (known locally as the *Yas'ur*), complete with Mirage and Phantom II escorts, appeared an hour later to rescue the Israeli pilots who had ejected and the Syrians, bent on revenge, took the opportunity to prolong the melee. They succeeded in shooting down one Phantom II but at the cost to their own side of several MiG-21s. After the battle, the Israelis claimed a total of 12 MiG-21s destroyed for the loss of one but the Syrians, claimed 8 victories and admitted 5 losses. With the benefit of hindsight, most historians estimate 3 Israeli and 12 Syrian losses. Such is the fog of War!

◄
An Egyptian Air Force MiG-21MF manoeuvres in full afterburner. This was the principal MiG-21 version used by Egypt against the Israelis in the 1970s.

There were many reasons for the high losses of EAF and SyrAF MiG-21s including, as mentioned previously, their role as escort to MiG-17 fighter-bombers but the most likely interpretation is that the Arabs could not compete with the superior training and experience of the Israeli pilots and their first-rate planning and tactical shrewdness. These factors were acknowledged by the Arabs who strove to remedy the faults in time for the 1973 attack. Replicas of principal Israeli targets were created in the Libyan Desert and Egyptian pilots honed their skills alongside volunteers from Algeria, Pakistan, Iraq, Jordan, Libya and North Korea many of whom brought their own aircraft. To remedy the range problem of the MiG-21, emergency landing strips were built in the desert to allow pilots to refuel. Furthermore, the Arabs had an ace up their sleeve in the form of the

A rather weathered and faded Egyptian MiG-21MF serialled 8692.
▼

All photos via RART

Lon Nordeen

▲ **Egyptian MiG-21s – a PFS (left) and a PFM (centre) – are readied for a mission at Nile Delta AB in October 1973. The camouflage patterns on the Egyptian MiGs varied widely.**

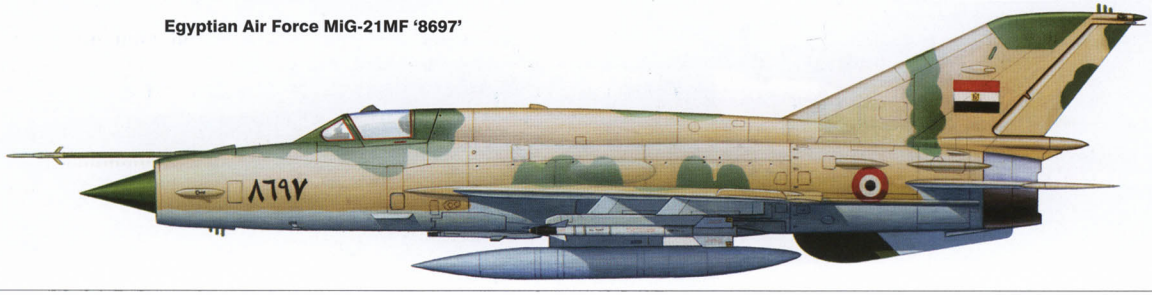
S-125 missiles which were a great threat to the Israelis, whose fighter-bombers could no longer roam the desert freely, attacking Arab troops and armour with impunity. So effective were the missiles that Arab generals were loath to risk their soldiers in areas with no SAM cover as will be seen in the next and 4th Arab-Israeli War.

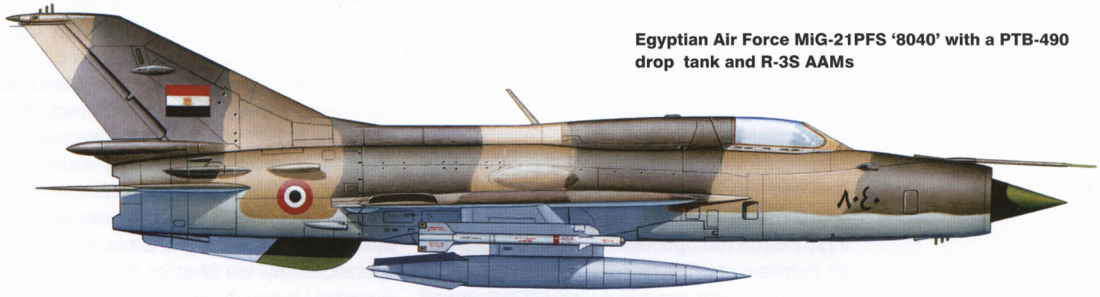
Yom Kippur (Day of Atonement) War

On 6th October 1973, the Egyptians attacked the Israeli Bar-Lev Line on the banks of the Nile. Simultaneously, the Syrians advanced on the Golan Heights, catching the Israelis on the wrong foot. The Yom Kippur (Day of Atonement) War, as it was known in the West, had begun. The Jewish festival also coincided with the Islamic 10th day of Ramadan; hence the war is known in Arab countries as the Ramadan War.

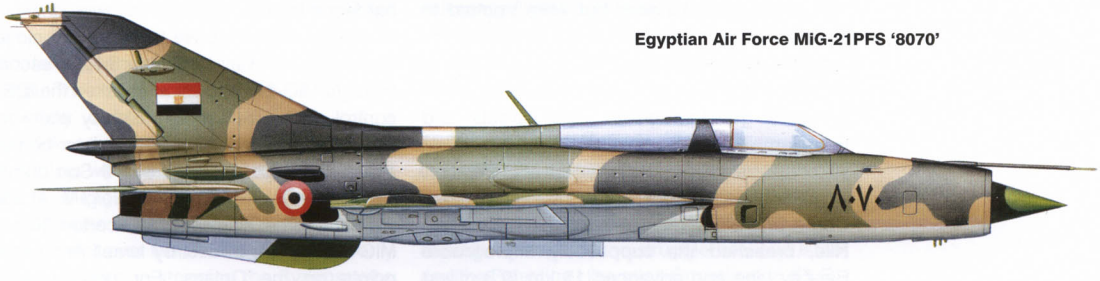
Egyptian MiG-21MFs from No. 104 Fighter Wing escorted MiG-17F and Su-7BMK fighter-bombers in the pre-emptive attack. MiG-21MFs of No. 102 Fighter Wing were also in action as fighter-bombers, with their four underwing hard points carrying either four 250-kg or two 500-kg bombs. More frequently, however, MiG-21s, which by that time were mostly MiG-21MFs and MiG-21PFMs with cannon armament as well as missiles, were used in conjunction with mobile SAM sites to deny the Israelis complete mastery of the air. After the first Arab strike, the mission of returning MiG-21s was the protection of airfields in anticipation of a strong Israeli counter attack. It was not the usual practice to have standing patrols over bases, as the Israelis were masters of ambush; the Egyptians preferred to keep the pilots on high alert on the bases, quickly scrambling them when required. Once in the air, they adopted the strategy of intercepting attackers from below with the intention of breaking up the formations, separating the aircraft carrying ECM equipment and scattering the others over anti-aircraft artillery and missile nests. This tactic was intended to maximise the total number of kills but at the possible cost of an increase in the number of MiG-21 losses. In order to succeed, it required extreme vigilance in reporting the approach of enemy aircraft; to this end, the Egyptians provided nearly 500 radar units plus an army of observers to warn of attackers flying low below the radar screen.

Egyptian Air Force MiG-21MF '8697'



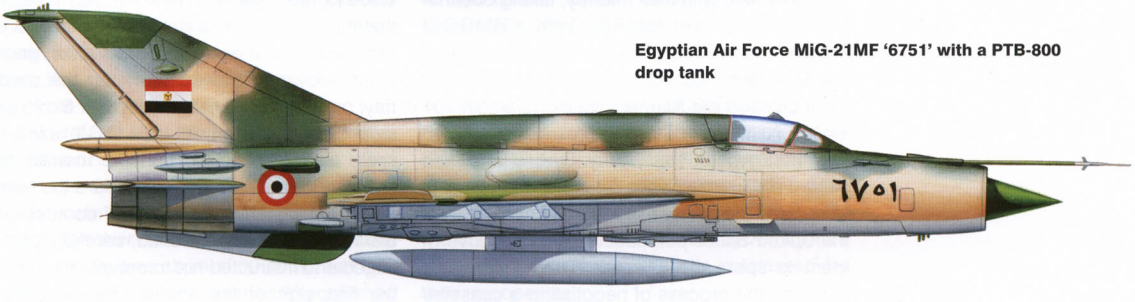


Egyptian Air Force MiG-21PFS '8040' with a PTB-490 drop tank and R-3S AAMs

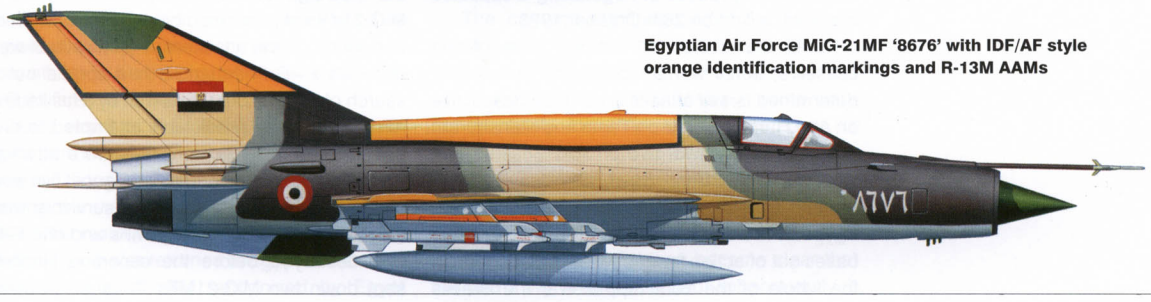


Egyptian Air Force MiG-21PFS '8070'

Egyptian Air Force MiG-21RF '8506' with PTB-490 drop tanks



Egyptian Air Force MiG-21MF '6751' with a PTB-800 drop tank



Egyptian Air Force MiG-21MF '8676' with IDF/AF style orange identification markings and R-13M AAMs

The Egyptians rejoiced in the success of the pre-emptive strike. As hoped, it had taken the Israelis by complete surprise. It was erroneously assumed that many bases in the Sinai Desert were out of action for between 24 and 48 hours and therefore, a second strike that day was cancelled. At the end of the first day, the EAF admitted the loss of 10 aircraft but assessed Israeli losses to be 27, a figure that unsurprisingly proved too optimistic. The Israelis claimed 38 victories, of which only five were MiG-21s.

The following, day nearly 300 IDF/AF aircraft attacked Egyptian bases but were spotted in sufficient time for over 60 MiG-21s to become airborne, making the area around the Nile Delta a setting for a huge air battle. Few Israeli bombers got through to their targets and Egyptian MiG-21s claimed five confirmed victories against the Israelis' seven MiG-21 'kills'.

By the second day of this clash, two Army Corps of the Egyptian Army had crossed the Nile, breached the supposedly impregnable Bar-Lev Line and advanced 15 km (9.3 miles) into Sinai without leaving the protective umbrella of S-125 mobile SAM launchers. On 8th October, an Israeli counter-attack was beaten off, after which each side waited for the other to attack. President Sadat, in an effort to relieve Israeli pressure on his struggling Syrian allies, insisted that his generals go on the offensive. The attack began on 14th October with a full frontal thrust that failed miserably, allowing the Israeli army to counter-attack the next day. Deviating from customary practice, the Israelis infiltrated the Egyptian lines with their infantry, taking out anti-tank defences and following with a divisional thrust to break through the line at the point where the Egyptian Second and Third Armies met. They crossed the Nile, advancing to within 101 km (62.76 miles) of Cairo before turning about to trap the Egyptian Third Army. By this time both sides were heavily dependent on massive airlifts to replace their losses in materiel. At this point, the United States persuaded the Israeli government to spare the Egyptian Third Army, thus assisting the process of negotiating a ceasefire that was ratified on 26th October 1973.

Until the accredited starting date of the ceasefire, aerial warfare continued apace with determined Israeli attacks on EAF air bases: five on Abu Hammad, four on Tanta and Mansourah, three on Salihiyatwo, two on Abu Souweir and one each on Beni Sueif, Bir Arayida and Quwaysina. None succeeded in destroying any Egyptian aircraft on the ground or in putting the bases out of action for more than a few hours. In the whole of the Yom Kippur War the Israelis claimed 73 confirmed victories over Egyptian MiG-21s; in their turn, Egyptian MiG-21s claimed 27 confirmed kills and 8 probables.

Syria also attacked Israel on 6th October 1973. At that time, the Syrian Air Force (SyrAF) had ten MiG-21 Squadrons with about 100 operational aircraft of which the majority were MiG-21F-13s plus some MiG-21PFs, 'PFSs and 'PFMs and 21 MiG-21MFs. 115 more MiG-21MFs were due to arrive in 1973 but would not be operational by the start of the war. To avoid exposing inexperienced pilots to the battle-hardened Israelis, the SyrAF allowed only pilots of captain rank or above to fly supersonic jets. Instigating the war, 12 Syrian Su-20s escorted by eight MiG-21s of 54 Sqn attacked the IDF/AF control centre at Khevron. Shortly afterwards, 20 Su-7BMKs and 16 MiG-17 fighter-bombers escorted by six MiG-21MFs of 8 Sqn bombed three radar sites on the Golan Heights. At about the same time, 12 MiG-21s escorted 30 or so MiG-17s aiming to destroy Israeli Army strong points on the Golans. For good measure, MiG-21s escorted more fighter-bombers to attack Israeli tank parks. None of these raids was interrupted by fighters. A second wave, however, came up against Israeli fighters: while escorting Su-7BMKs and MiG-17s the MiG-21MFs of 5 Sqn shot down an A-4E and claimed a Mirage IIICJ but lost one of their number to an Israeli IAI Nesher fighter of 144 Sqn. Elsewhere, two more MiG-21s fell to the guns of 144 Sqn.

At the start of the attack, the Syrian army outnumbered the Israeli 9 to 1 in manpower and 1,300 to 180 in tanks. Therefore, it is no surprise that they made substantial gains on the first day of the war. With the arrival of Israeli reservists, the Syrian advance slowed down on the second day, prompting them to rely on their S-125 SAM defences rather than risk their MiG-21s in a full-scale battle with Israeli fighters. Instead, they planned to use their MiG-21s to lure the Israelis into a trap. First, under cover of darkness, the SAM sites were repositioned, carefully camouflaged and instructed not to activate the radar at the first sign of the enemy. Several pairs of MiG-21s were positioned behind the sites, ready to pounce on the attackers. A first wave of well-escorted F-4E Phantom IIs had spread out in search of targets, only to be met by a fusillade of missiles. As they predictably attempted to dive beneath the radar screen, they were attacked with radar-controlled anti-aircraft guns; five were shot down by ground fire. The survivors were intercepted by 5 Sqn MiG-21MFs and one F-4E was destroyed before the escorting Neshers shot down two MiG-21MFs. Another escaping

pair of F-4Es was bounced by more MiG-21MFs, one Phantom later crashing before two F-4Es following behind destroyed another MiG-21MF. Whilst both of these last two losses were admitted by the IDF/AF, neither was claimed by Syrian fighters. On the same afternoon, three Mirage IIICJs and an A-4E were shot down without loss but three returning MiG-21MFs were downed by their own AA guns and SAMs.

A strong Iraqi contingent comprising 9 Sqn with 18 MiG-21PFs, plus 18 Su-7BMKs and 20 Hawker Hunter F.58s, was based at al-Mezzeh. It included pilots from East Germany, Great Britain, Libya, Poland and the USSR as well as Iraq; later they were joined by the MiG-21MFs of 17 Sqn. Their first sortie was on 7th October when they claimed two A-4Es but lost a MiG-21PF and a Su-7BMK. On the following day four Hunters were lost, one to Israeli SAMs and three to Mirages. The IDF/AF mounted an immense strike directed at halting the advance of Syrian tanks over the Golan Heights. Not only did they succeed in stopping the Syrians, who approached Nafah where the HQ of the Israeli 7th Armoured Brigade was based, but from this point the Syrians were forced slowly back. However, Israeli losses while supporting their army were huge: 23 aircraft were shot down and 40 damaged (most of them by ground fire, but three F-4Es fell foul of Syrian MiG-21PFMs). The SyrAF lost 13 aircraft to Israeli fighters, including six MiG-21s.

Slowly but inexorably the Syrians were pushed back over their start line until, on 10th October, the last unit left the Golan Heights and the Israeli Army flooded deeper into Syria, forming what became known as the Bashan Salient, the extreme of which was 40 km (25 miles) from Damascus. The Syrian Army, with the help of 30,000 Iraqi soldiers, counter-attacked and halted the Israeli advance but failed to dislodge them from the salient. A United Nations-brokered ceasefire came into operation on 26th October 1973. In the Syrian-Israeli struggle, the Syrians claimed 30 confirmed kills by MiG-21s while the Israelis stated 29 confirmed air-to-air victories over Syrian MiG-21s. It is important not to draw too many conclusions from statistics aimed only at showing how the MiG-21 fared in the war.

As a result of their initial successes, both Egypt and Syria were vindicated in their own eyes and those of the rest of the Islamic World for starting the war and excused their failures in 1967. The result was the Camp David Accord, whereby Sinai was returned to Egypt, the state of Israel became officially recognised by Egypt and ultimately, Egypt left the Soviet sphere of influence.

There was still friction leading to the occasional clash between Egyptian and Israeli fighters after 26th October 1973. For example, on 6th December of the same year, Egyptian MiG-23MFs claimed to have shot down an intruding F-4E, the Israelis denied the loss and for their part claimed to have destroyed a MiG-21MF, a loss denied by the Egyptians. A few Soviet Air Force MiG-25RBs remained in Egypt and continued their unmolested reconnaissance flights over Israel until 15th December 1973; they were escorted to and from the Israeli border by MiG-21MFs. The last Soviet 'advisor' left Egypt in August 1974.

1982 Lebanon War

In 1976 at the invitation of the Lebanese government, the Syrian Army moved into and occupied the Lebanon, initially to protect Christian minorities caught in the struggle between Israel and the Palestine Liberation Organisation (PLO), which comprised various Palestinian militias. The relative peace that existed between Syria and Israel soon broke down as the Syrians were seen to give help and support to the PLO. After a failed PLO attempt to assassinate the Israeli Ambassador to the United Kingdom, leaving him gravely injured and paralysed, the Israeli Army invaded Lebanon on 6th June 1982. Since the end of the Yom Kippur War there had been significant, if sporadic, air battles between Israel and Syria in which the IDF/AF shot down 33 confirmed Syrian aircraft, including 24 MiG-21MFs; the SyrAF claimed eight confirmed air victories, five by MiG-21MF and three by MiG-23MSs. It was hardly a fight between equals; the IDF/AF flew McDonnell Douglas F-15A Eagles and General Dynamics F-16A Fighting Falcons armed with AIM-9D and AIM-9L missiles while the SyrAF comprised mostly MiG-21MFs plus some MiG-23MSs still carrying the old unreliable R-13 missiles. SyrAF fighters and missiles were substantially outclassed by their opponents.

The carnage continued after the invasion began and between 6th and 11th June 1982 the Israelis shot down 79 confirmed SyrAF aircraft, of which about 45 were MiG-21MFs – some were not positively identified as MiG-21s, only as MiGs. In return, the SyrAF claimed three confirmed victories, two of them by MiG-21s, and 15 probables. This time the Syrian pilots were experienced and soundly trained but, although they fought valiantly, it soon became clear that the MiG-21MF was outclassed; subsequently, it

via RART

▲ **Yugoslav Air Force MiG-21*bis* fighters, such as 17409 (seen here in old-style insignia), saw action in the civil war following the disintegration of Yugoslavia.**

was only used in air battles if no MiG-23MSs were available.

In late 1982 a Multinational Force of US, French and Italian soldiers arrived in the Lebanon and arranged the deportation of over 14,000 PLO combatants to other Arab countries. Israeli forces started to leave in May 1983 for the newly set up Security Zone, completing the withdrawal in June 1985. The Syrians finally withdrew from the Lebanon on 26th April 2005.

Yemen – North versus South

MiG-21s were first delivered in 1968 to the Yemeni Arab Republic Air Force (YARAF), the air arm of North Yemen, when a batch of MiG-21PF (*izdeliye* 76A) fighters arrived. A second tranche followed in the early 1970s, this time of an unknown variant.

Shortly after the British left Aden in 1967, a People's Democratic Republic of Yemen Air Force (PDRYAF) was formed in South Yemen.

The PDRYAF received its first MiG-21F-13s in 1971 and South Yemeni forces invaded North Yemen on 25th February 1979. Unfortunately, there are no records of MiG-21 vs MiG-21 battles but it is plausible that they occurred before international pressure forced a return to the start line on 15th March of the same year. An attempted coup by a Moscow-backed group led to a civil war in South Yemen in which 75% of the PDRYAF was destroyed. No details are available of aircraft involvement in either the coup or the civil war but the country remained in a chaotic state and on 22nd May 1990, the two Yemen were united as the Republic of Yemen with its air arm called the Yemen Republic Air Force. The MiG-21s subsequently gave way to MiG-29s and Su-27s.

Wearing the new-style roundels and fin flash, Yugoslav Air Force MiG-21*bis* 17213 sits under camouflage netting, with two R-3R AAMs and four R-60M AAMs on the wing pylons. ▼

via RART

Yugoslavia Torn Apart

Slovenia

After a referendum on 23rd December 1990 produced an 88% vote for independence from Yugoslavia, the former Federal Republic of Slovenia declared itself independent on 25th June 1991. The declaration was followed almost immediately by the 10-Day War from 27th June to 6th July 1991, as a result of which its independence was accepted by the Yugoslav government. There is no evidence of the use of MiG-21 fighters in this conflict.

Croatia – Birth Pangs

The Federal Republic of Croatia declared itself independent of Yugoslavia on 25th June 1991 and the Croatian War of Independence began when the Yugoslav Federal Army tried to occupy the new state. MiG-21*bis* fighters were not available to the Croatian Air Force (*Hrvatske Zračne Snage*, HZS) until the first defector from the YuAF flew in on 4th January 1992; he was followed by a further two on 15th May 1992. The three aircraft, now serialled 101-103, formed the newly created 1 *Eskadrila Lovaćkih Zrakoplova* (Fighter Squadron, ELZ). They were quickly deployed to attack Yugoslav Army positions in Croatia and Bosnia but there are no records of interceptions of, or by, Yugoslav Air Force (YuAF) aircraft. Two YuAF MiG-21*bis* attacked a Cessna 172 with gunfire, but its pilot, manoeuvring skilfully, managed to escape and make a safe landing at a Slovenian airfield. 101 was ill-fated: on 24th June 1992 it was shot down by an *Igla* (Needle; SA-14 *Gimlet*) man-portable air defence system (MANPADS) operated by a Croatian soldier who mistook it for a YuAF aircraft; the pilot ejected but did not survive.

Fearing a missile attack on Zagreb, 102 and 103 were scrambled on 14th September 1992 to locate and destroy a number of Yugoslav LUNA surface-to-surface missile launchers that were being conveyed on trucks tracked by a Croatian reconnaissance drone. The strike missed the launchers, but hit other vehicles. 103 was shot down by a Yugoslav Army *Strela* (Arrow; SA-7 *Grail*) MANPADS, killing the pilot.

Nothing more was heard of further Croatian MiG-21 exploits until after 16 MiG-21bis fighters (serialled 104-119) and four MiG-21UM trainers (serialled 160-163) were purchased from the

Ukraine and made airworthy, using the 20 extra MiG-21s bought earlier as a source of spares. Together with 102, the new MiG-21s formed 21 ELZ (formerly 1 ELZ) at Pleso AB near Zagreb and 22 ELZ at Pula. These squadrons were put to good use in May 1995 in the ground attack role when the Croats mounted an offensive called Operation *Bljesak* (Flash) against Krajina, a Serb-populated part of Croatia that wished to retain its loyalty to Yugoslavia and to that end had proclaimed itself the Republic of Serbian Krajina. The Western Slavonian province of Krajina was subsequently annexed by Croatia.

Three months after their success with Operation *Bljesak*, the Croats confidently launched Operation *Oluja* (Storm) and, thanks to successful international pressure on Yugoslavia not to interfere, they quickly took the remainder of Krajina, except for a small strip bordering Serbia. Once again, they used MiG-21s for ground attack. An air battle was foiled on 7th August 1995 when two Croatian MiG-21*bis* were scrambled but in spite of a diligent search they failed to find the two Yugoslav SOKO J-22 Orao fighter-bombers that had been attacking Croat forces.

Bosnia-Herzegovina Wars against Yugoslavia & Croatia

In 1990 the Federal Republic of Bosnia-Herzegovina constituted about 43.7% Bosniaks, 17.3% Croats, 31.4% Serbs and 5.5% other ethnic groups. After the secession of Croatia and Slovenia from Yugoslavia, there was a declaration of sovereignty by the Republic of Bosnia-Herzegovina, which decided to hold a referendum between 29th February and 2nd March on the option to remain as a Federal Republic or become independent. Correctly anticipating a vote for independence, the people of Serbian extraction on 9th January 1992 set up a new separate state called the Serb Republic of Bosnia and Herzegovina but the new state would still be part of Yugoslavia. Srpska was the Serbo-Croatian for 'Serbia' and on 12th August 1992 the name of the new state was abbreviated to Republika Srpska.

War broke out in March 1992 and continued until 14th December 1995, involving Yugoslavia, Srpska, Croatia and Bosnia-Herzegovina plus (in 1995) NATO. At times Croatia fought alongside Bosnia-Herzegovina against Yugoslavia and Srpska, sometimes against all of them.

No specific examples have been found of MiG-21 involvement but it is reasonable to assume that they were employed by both Yugoslavia and Croatia for ground attack.

Kosovo

The only record found of the use of the MiG-21*bis* in the Kosovo War was the alleged attack with R-60 air-to-air missiles on 10th June 1999. Three times the MiG-21bis fighters of 83. *Letna Brigada* of the Yugoslav Air Force attacked the Albanian Air Force Shenyang F-7As that had breached Kosovo airspace. Claims were made for three Albanian F-7A to have been shot down, but this cannot be accurate as of the 12 F-7As that were delivered nine were noted in storage in 2005 and two had reported ly crashed, one in 1974 and the other on 29th March 1982.

Considered to be part of the campaign to persuade the Belgrade government to negotiate a deal on Kosovo, the NATO bombing of Yugoslavia (Operation *Allied Force*) started on 24th March 1999 and finished on 10th June 1999. No record has been found of interceptions of NATO aircraft by Yugoslav Air Force MiG-21*bis* fighters, but it is known that some of the latter were damaged in the bombing.

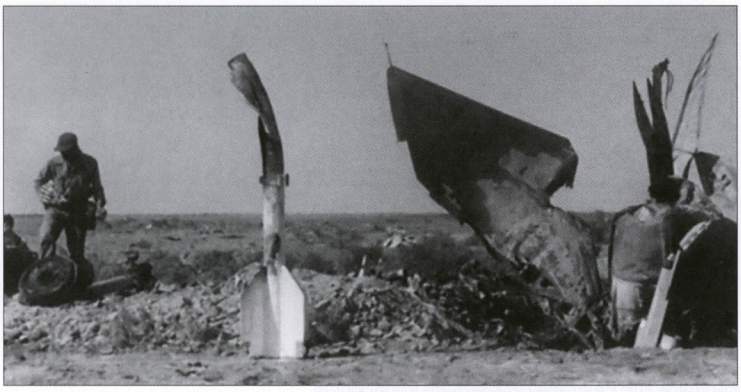
Iraqi Wars

In the 1970s, the Kurds in Northern Iraq were supported in their armed struggle for independence by Iran. Not only did Shah of Iran Mohammad Reza Pehlevi send substantial amounts of arms and munitions but also, Iranian troops made incursions into Iraq. The authorities in Baghdad sent their army supported by large

via Internet

◄ **An Iraqi Air Force pilot climbs into his MiG-21MF serialled 1190 and is instructed before a sortie.**

Key Publishing



▲ **The wreckage of an Iraqi MiG-21 shot down by the Iranians, with the remains of an R-13 AAM alongside.**

via Internet

▶ **An Iraqi MiG-21*bis*. Surprisingly, the aircraft has no serial.**

numbers of aircraft including MiG-21PFMs and the MiG-21MFs, delivered in 1973, to put down the rebellion. No. 17 Fighter Squadron (17 FS) with its MiG-21MFs had returned from the Yom Kippur War at the end of October 1973 and was among the units sent to deal with the rebellion. Because SAM batteries accompanied the Iranian troops, Losses of Iraqi aircraft were far greater than anticipated.

Iran-Iraq War or First Gulf War

In January 1979 during the Iranian Islamic Revolution, the Shah fled the country, and by December Ayatollah R. M. Khomeini was running Iran according to strict Islamic laws. In a successful effort to hold on to power, the new government purged the armed forces of officers thought to be disloyal to the new regime but in implementing this action, the Air Force suffered badly. This did not pass unnoticed in Baghdad and incited those planning an invasion of Iran to capitalise on the temporary weakness. In fact, it was the ruling factor in timing the attack to start before completion of the delivery of new Dassualt Mirage F.1EQ fighters from France and MiG-25PD interceptors from the USSR.

Technically, the Islamic Republic of Iran Air Force (IRIAF) was well ahead of its Iraqi opposite number not only in fighters, such as the Grumman F-14A Tomcat, but also in missiles, radar and ECM equipment. It was generally quite rightly assumed that Iran would not obtain replacements and spares but what was overlooked was the Iranians' ability to innovate, make do and mend.

There had been trouble and local fighting on the borders between the two countries for some time before Iraq made a pre-emptive strike on Iranian airfields and invaded the country. The attacks on Iranian airfields took the form of two strikes, both of which failed, with substantial Iraqi aircraft losses. The invasion by the army fared more successfully and before the end of the year, the Iraqi army was at the gates of Abadan.

When the First Gulf War began, the fighter strength of the Iraqi Air Force comprised about 90 MiG-21MFs, a few dozen MiG-21PFMs and the remainder of the MiG-21PFs and MiG-21F-13s from the Arab-Israeli wars of 1967 and 1973. These aircraft equipped Nos. 5, 9 (MiG-21PF/MF), 12, 17 (MiG-21MF) and 18 Fighter Squadrons plus No. 1 Fighter-Reconnaissance Squadron (MiG-21R).

MiG-25PD fighters arrived after the start of the war and became operational in May 1981 and the Mirage F.1EQ in October 1981; first deliveries of the MiG-21*bis* took place in February 1983 and went to No. 11 Squadron.

1982 saw the delivery of the first 40 of an order for 70 Chengdu F-7Bs, a Chinese development of the MiG-21F-13. They were not state of the art fighters but Iraq, desperate to replace its losses was having difficulty finding sufficient aircraft. On arrival, the F-7Bs and their two-seat trainer counterpart, the Guizhou FT-7, were used by Nos. 5 and 6 Fighter Squadrons, unfortunately, very little is known about their participation or lack of it in the war. It is possible that they were misidentified as MiG-21F-13s; alternatively, the assumption usually made is that they were used for conversion training or ground attack work. If they were so disparaged, it begs the question, why were they still in use in 2001 with the same two squadrons and why did some persist until 2003?

On the Iranian side, the best fighter was the F-14A that was far superior to the MiG-21MF; in second place came the F-4E Phantom II against which, other things being equal, the MiG-21MF could hold its own. Unfortunately for the Iraqis, their other equipment and especially their avionics bore no comparison to the Iranian counterparts. The second-line IRIAF fighter was the Northrop F-5E Freedom Fighter, a fine aircraft much admired by the Soviet authorities, but not as good as the MiG-21MF. The Iranian strongpoint at the beginning of the war was its possession of superior missiles. Iraq was saddled with the unreliable R-13 until April 1981,

when, assisted by the French, the first MiG-21MF was successfully modified to fire Matra R.550 Magic Mk 1 missiles. Before the Iranians realised what was happening, in the space of one week MiG-21MFs had shot down two F-4Es, two F-5Es and a helicopter and lost only one MiG-21MF. However, such was superiority of the Tomcat with its AIM-7E Sparrow medium-range and AIM-54A Phoenix beyond-visual-range missiles, that MiG-21 pilots were happy to obey instructions to avoid contact with the F-14A. Supplies of the Magic Mk 1 were difficult to obtain and in 1983, to tide them over until more arrived from France, the Iraqi Air Force chiefs negotiated a deal with Jordan for 200 AIM-9B Sidewinder missiles in return for two captured F-5E fighters and supplies of oil.

Having almost reached Abadan in 1980, the Iraqi army could advance no further; fanatical Iranian counterattacks in 1981 failed to retake much ground but in 1982 the Iraqis began to be pushed back. Realising that he was in as strong a position as he was likely to get and concerned by the losses, in May 1982 the wily Saddam Hussein offered to negotiate a withdrawal but the equally wily Iranians rejected the offer and, using 'human wave' attacks, steadily forced the Iraqis back into their own country. Persisting with their expediency, the Iranians implemented an assault on the Al-Faw oil port near Basra that launched the southern front into a war of attrition. From February 1984, the Iraqis resorted to chemical warfare and, having received fresh supplies of aircraft from France and the Soviet Union, pushed on with a major air offensive. In response, the Iranians stepped up the bombing of Iraqi cities and on 9th February 1986, an amphibious assault captured the Al-Faw port and its peninsula, which were not recaptured until April 1988. In the meantime, as the battles in the South continued, the Iraqis, supplied with French AM 39 Exocet missiles, stepped up the attacks on shipping in the Gulf of Persia. As a result of shipping losses and heavy and sustained attacks on the Kharq Island oil terminal, Iran's oil exports were halved. This reduction in oil supply, combined with Syria's blocking of the Banias pipeline, had the predictable effect of dramatically increasing oil prices and on 20th July 1988 UN Security Council Resolution 598 called for an immediate ceasefire, a command that Iran rejected. The Iraqis, having recaptured the Majnoun Islands, went on to mount an armoured strike penetrating deep into northern Iranian territory. These setbacks, combined with superpower pressure, finally forced the Iranians to accept the UN Resolution. Successes in the final months of the war enabled the Iraqis to claim a military victory but to the rest of the world it was a Pyrrhic victory.

Some interesting conclusions can be drawn from the table below showing the number of MiG-21 claimed by the Iranians to have been shot down by their aircraft and the number of victories claimed by Iraqi MiG-21s based on data collected by the Air Combat Intelligence Group (ACIG) at http://www.acig.org/artman/publish:

MiG-21 kill/loss statistics in the Iran-Iraq War

Year	MiG-21s shot down by Iranian aircraft	MiG-21s' aerial victories
1980	28	21
1981	8	10
1982	7	5
1983	1	5
1984	3	2
1985	1	0
1986	1	0
1987	0	0
1988	0	0
Total	**49**	**43**

It is assumed by the authors that both sides have exaggerated their claims in the same proportions.

Although it is unwise to draw too many conclusions, reason suggests that the role of the MiG-21 changed after 1985 being replaced in fighter-bomber and escort fighter roles in the main theatres of operation by more modern aircraft. It is also probable that it was delegated to point defence of cities, oil refineries and similar important potential targets on quieter sections of the front. One interesting fact is the 1986 Iranian victory claim for a MiG-21 brought down by cannon fire from a Bell AH-1J Cobra helicopter.

It cannot be said that the MiG-21MF disgraced its illustrious forebears because, in

via internet

The remains of several Iraqi aircraft destroyed by Allied bombings at an Iraqi airfield, with a Chengdu F-7B in the foreground.
▼

via internet

▲ **To the victor belong the spoils: A US Marine Corps Sikorsky MH-53E Super Sea Stallion of HMH-465 'War Horses' prepares to lift Iraqi Air Force F-7B '6578' which was captured in almost undamaged condition by the Marines.**

spite of having to use unreliable missiles, in the first two years of the war, it claimed 43 victims in aerial battles against 49 alleged losses.

Second Gulf War – Operation *Desert Storm*

On 2nd August 1990, the Iraqi Army invaded and quickly occupied Kuwait. There were no reports of the involvement of any MiG-21s or Chengdu F-7Bs.

During the invasion of Iraq by Allied Gulf forces (Operation *Desert Storm*) in 1991, and the subsequent policing of Iraqi airspace, many MiG-21s and F-7Bs were destroyed on the ground but only four in air combat. On 17th January 1991, two USN F/A-18Cs of VFA-81 shot down two MiG-21*bis*, the first with AIM-7M and the second with AIM-9M missiles. On 6th February 1991 two MiG-21*bis* were shot down by the same F-15C, piloted by Thomas N. Dietz of 53rd TFS/36th TFW, with AIM-9M missiles.

Many IrAF aircraft flew to Iran in the hope of finding sanctuary and returning after the war but the Iranians did not return them and there are stories in circulation that some MiG-21s were used by the IRIAF.

Third Gulf War – Operation *Iraqi Freedom*

On 20th March 2003 the forces of USA, the UK and their allies invaded Iraq; Baghdad fell on 9th April and major military operations were completed by 1st May 2003. The most surprising feature of the war was the complete absence of any resistance by the Iraqi Air Force to the invasion – perhaps because, since 1991, thanks to an arms embargo, the IrAF had been desperately short of spare parts to keep its aircraft flying. Nevertheless, towards the end of 2000 they were successful in obtaining stocks illegally from Belarus – a source that, unfortunately for them, dried up just one year later. In mid-March 2003 Saddam Hussein took the drastic step of personally ordering that all aircraft be disassembled and hidden by burying them in the sand, apparently a not infrequent order but one which was never officially countermanded. Officers were 'discouraged', to put it mildly, from acting on their own initiative and therefore, the inaction of the IrAF is understandable.

During Operation *Iraqi Freedom*, apart from some MiG-21s being destroyed on the ground, the only action in which MiG-21s were involved was in their flight to Iran to seek sanctuary. The actual number of aircraft that arrived in Iran between 1991 and 2003 is not known but estimates vary wildly from 100 to 400. What is certain is that substantial numbers have been incorporated into the IRIAF. Photographs exist of MiG-21PF (*izdeliye* 76A) and MiG-21U (*izdeliye* 66-600) in Iran but no reliable information about their deployment can be found.

The War in Afghanistan

The use of the MiG-21 by the Soviet Air Force in the Afghan War has been dealt with in the previous chapter. However, the Afghans themselves also operated the type and used it in the war. As of 1978, the Democratic Republic of Afghanistan Air Force (DRAAF) consisted of six air regiments based at Kabul IAP, Bagram, Shindand, Kandahar and Mazar-e-Sharif. The garrison at Bagram commanded by Col. Gulyam Sahi was the DRAAF's best-trained garrison; it included the 322nd Fighter Regiment commanded by Lt. Col. Latif, which operated the MiG-21 and mastered combat tactics with the type.

The Air Force was actively involved in the Saur Revolution that began on 27th April 1978 and precipitated the Afghan War. Air Force units joined the action at 13.30 hours; initially only the transport aircraft and helicopters of the Kabul regiment were involved, but the 322nd Fighter Regiment and the co-located fighter-bomber unit flying Su-7Bs were soon flung into the fray, shouldering the main workload. The fighting continued all day and all night, ceasing at 10 o'clock the following morning. About 70% of the DRAAF's flight crews took part in the revolution, and the workload of individual pilots varied widely – from 1 to 14 sorties. The MiG-21 unit's eleven pilots made 50 sorties between them; Maj. Mir Gausuddin, the chief of combat training, had the top score with 14 sorties. Despite not having flown for a while, four MiG-21 pilots and three Su-7 pilots successfully performed 21 night sorties. The primary targets were the Presidential palace and other administrative buildings in Kabul and the HQ of the Central Army Corps outside the city. To avoid excessive collateral damage the pilots used only cannons and FFARs when attacking targets in the city; this was not the case with the HQ, where the air strikes were conducted on a larger scale and bombs were used. Two aircraft were lost in the course of these sorties, including a MiG-21U trainer which was shot down by ground fire (the pilot ejected safely), and a further three single-seat MiG-21s were hit but made it back to base.

In keeping with the agreement signed after the revolution the number of Soviet advisors in the Afghan Armed Forces increased dramatically and their functions were expanded. They were now seconded to a greater number of units – in the case of the DRAAF, right down to squadron level.

The agreement also envisaged re-equipment of the DRAAF's fighter and fighter-bomber units: the MiG-21PFM/MiG-21FL was to be replaced by the MiG-21*bis*, while the Su-7B would be phased out in favour of the 'swing-wing' Su-20. The first MiG-21*bis* fighters were delivered in 1979. A large group of Soviet flying instructors, engineers and tutors arrived in Afghanistan to handle the conversion training process. As early as July 1979 the first four Afghan pilots received their type ratings on the MiG-21*bis*, thanks largely to instructor Zinov'yev. Unfortunately he crashed fatally at Bagram on 10th September 1979 while making a demonstration flight in the new fighter.

To speed up the introduction of the new hardware the Soviet advisors recommended that DRAAF pilots should master the MiG-21 without using an interim type (the MiG-17). The Afghans, however, rejected this recommendation outright; their reasoning was that the DRAAF was desperately short of flight and ground crews and the task of training them was complicated by the generally poor health and widespread illiteracy of the local population. As Mir Ghausuddin put it, *'Your kids are born to the babbling of a TV set, they can turn on the lights and the tape recorder and play with the steering wheel of a car before they're old enough to talk. When they grow up, they are not scared to let go of one control stick and grab hold of another. Our kids are just letting go of a donkey's tail or mother's skirt, and you want to put them into a modern aircraft? Get real. Don't push us and don't hurry'.*

However, state-of-the-art hardware and good training were not the only factors necessary to assure success; the pilots had to know what they

via internet

▲
A MiG-21*bis* in DRAAF markings landing at Bagram.

MiG-21UM '561 White' and MiG-21*bis* '923 White' in the insignia of the Dostum-Gulbuddin Air Force (DGAF).
▼

via internet

via Internet

via Internet

▶ **Angolan Air Force (FAPLA) MiG-21*bis* fighters serialled C310 and C314 share a hardstand with a Cuban Air Force MiG-29UB. Many of the Angolan MiG-21s were flown by Cuban pilots. Note the different camouflage schemes. Interestingly, both aircraft have black/yellow/red striped rudders instead of carrying the FAPLA roundel on the fin.**

were fighting for. The Afghan Armed Forces were definitely failing in that. Not infrequently mutiny flared up in the government troops, and individual officers or even units would switch allegiance and support the Mujahideen rebels opposing the Kabul government. Being aware that they were fighting against their compatriots, some pilots declined to fly on various grounds, including personal and religious ones. Other pilots sabotaged sorties by taking off too late or dropping the bombs somewhere in the wastelands instead of the target.

Hostilities in Afghanistan continued after the Soviet withdrawal and ultimately led to the fall of Najibullah's government in May 1992. After the opposition seized Kabul, the various warlords tore the Afghan AF apart and started using the remnants against each other. Eventually, however, the MiG-21s were grounded by lack of spares, fuel and ammunition.

Albanian intervention in Kosovo

While the Yugoslav army fought Kosovo Liberation Army guerrillas, there were several instances of cross-border flights of both Yugoslav MiG-21*bis* and Albanian Shenyang F-7As and at least one ended in a face-to-face battle on 10th June 1999. Although the Yugoslav Air Force claimed to have shot down three on that occasion, it cannot be confirmed since, of the 12 F-7As delivered to Albania, two had reportedly crashed before the altercation, one in 1974 and the other on 29th March 1982 and nine were safely in storage in 2005.

MiG-21MF C48 lies on its belly after a forced landing caused by hydraulics failure in 1976. ▼

via Internet

Angolan Civil Wars

In November 1975 Angola gained independence from Portugal but the three separate insurgent groups that had fought for that independence could not agree on how the country should be run or, more probably, who should be head of state. The three groups were:

1) MPLA (*Movimento Popular de Libertação de Angola*), the Marxist Popular Movement for the Liberation of Angola supported by the USSR, who supplied them with arms via Cuba;

2) FNLA (*Frente Nacional de Libertação de Angola*), the Angolan National Liberation Front backed by South Africa, Zaïre and the CIA;

3) UNITA (*União Nacional para a Independência Total de Angola* – the National Union for the Total Independence of Angola).

The first task of the Cuban troops, who had landed in Angola in February 1975 before the Portuguese handed over power, was to convert the MPLA guerrillas into a professional army.

In September 1975 the South African Defence Force (SADF) mounted an expedition into Angola, linking up with FNLA guerrillas to march on Luanda and approaching within 20 km (12.4 miles) of the city by 18th December 1975. By this time, enough Cuban soldiers and equipment had arrived to halt the SADF advance. The South African government took the view that, as international displeasure was already mounting over the policy of Apartheid, they would be unwise to exacerbate the bad feeling and began withdrawing from Angola in January 1976. The FNLA and Portuguese troops took over the SADF positions. The US, not wanting to become embroiled again in a foreign war, also backed down, instructing the CIA to cease all operations in Angola.

As a result of the Cuban government sending MiG-17 and MiG-21MF fighters and pilots, and the USSR supplying MiG-21F-13s with Soviet pilots, the MPLA was able to field a squadron of each type that became operational on 21st January 1976. This date is acknowledged as the day on which the *Força Aérea Popular de Angola – Defesa Anti-Aviões* (Angolan Air Force and Defence Force, FAPA-DAA) was created. Their first mission was to attack FNLA bases in

Angolan Air Force MiG-21MF C48 that was lost in an accident in 1976

Angolan Air Force MiG-21*bis* (*izdeliye* 75A) C314

Redondo and Nea Lisboa on 25th January 1976 and within a few weeks MiG-21MF fighter-bombers had strafed airfields at Nea Lisboa, destroying or damaging a number of light aircraft used to bring in supplies.

The MPLA, now reinforced by 15,000 Cuban troops and air support, overpowered the FNLA, who by the end of March 1976 had ceased to exist, its supporters fleeing to Zaïre or allying themselves to UNITA. The latter could now count on South Africa, Rhodesia and covert CIA help. In the meantime, MPLA, which controlled the capital, Luanda, assumed the mantle of government of Angola from the Portuguese.

In March, having convincingly defeated the FNLA, the MPLA approached the common borders of Angola, Zaïre & Zambia and, turning south, moved steadily towards their next target, UNITA-held territory. On 13th (or 3rd?) March MiG-21MFs attacked Gago Coutinho airfield with unguided rockets, destroying an Air Congo Fokker F.27 Friendship 600 airliner (9Q-CLO *Goma*, c/n 10395) hired by the CIA to bring in food from Rhodesia (some sources, however, say the cargo was arms, not food!). The President of Zaïre, Mobutu Sese Seko, whose country owned Air Congo, demanded $2 million in compensation from the CIA with the threat of changing sides if not satisfied but he was eventually persuaded to settle for $600,000. UNITA retreated to the haven of the undeveloped South-East of Angola, which, having few roads, was ideally suited for guerrilla warfare. The People's Armed Forces for the Liberation of Angola (FAPLA, *Forças Armadas Populares de Libertação de Angola*), originally the military wing of MPLA, became the official name of the Angolan armed forces. It continued the struggle against UNITA, which was rapidly becoming stronger with US help. Of paramount importance to UNITA was the supply of MANPADS and anti-aircraft guns, as it had no air force of its own. However, it did have support from the South African Air Force (SAAF), which vigorously defended the difficult-to-perceive border against any accidental incursions by FAPA-DAA aircraft and did not hesitate to venture over the border to attack MPLA targets. Records for 3rd April 1986 mention an Angolan MiG-21MF or MiG-21*bis* erroneously shooting down a Lockheed L-100-30 (civil C-130 Hercules) supposedly carrying arms for UNITA but actually working for TAAG, the Angolan national airline.

Matters came to a head in 1987 when FAPLA decided to attack UNITA cities of Jamba and

via RART

◀ **MiG-21*bis* (*izdeliye* 75B) C340 was flown to Namibia by a defector in 1989.**

Mavinga, and battle began at Cuito Cuanavale. Each side claimed victory; FAPLA suffered enormous losses of men, yet UNITA and SADF could not capture the city of Cuito Cuanavale. Either way, both sides were now prepared to negotiate and agreed to the withdrawal of foreign troops. Fighting nonetheless continued between the two antagonists until a ceasefire was agreed in 1991, leading to presidential elections in 1992 which Dr. Jonas Savimbi, the leader of UNITA, lost. Sporadic fighting broke out again, continuing until 22nd February 2002 when Savimbi was killed in an ambush, and a final and lasting ceasefire was agreed.

Throughout the fighting, MiG-21s played a leading role until the arrival of the MiG-23MF swing-wing fighters in the 1980s but owing to conditions of terrain and weather, attrition was very high.

Nothing is known of the fate of the MiG-21F-13s that were probably used for the defence of large cities but in view of the lack of information, they probably returned home with their Soviet pilots in the early 1980s.

19 MiG-21MFs are known to have been lost; three (possibly four) were claimed to have been shot down by SAAF Dassault Mirage F.1CZ pilots between 1981 and 1985. The following cases are known (in all cases the fighters were flown by Cuban pilots). On 15th March 1981 On 15th March 1981 a MiG-21MF piloted by Maj. Leonel Ponce Torriente fell victim to MANPADS near Cabinda; the pilot ejected and was rescued. On 2nd May a MiG-21MF flown by Capt. Carlos Benitez Estacio was hit by anti-aircraft artillery, crash-landing at Lubango. On 6th November 1981 SAAF pilot Maj. Johann Rankin shot down a MiG-21MF flown by Lt. Danacio Valdez near Mulondo; this was the first SAAF 'kill' after the Korean War.

On 5th October 1982 a second clash occurred between SAAF Mirage 5CZs and Angolan MiG-21MFs from Lubango; one of the MiGs was lightly damaged by cannon fire but all participants of the skirmish made it safely back to base. Another MiG-21 piloted by Capt. Raúl Fernandez Sanchez was lost at Lubango on 23rd April 1983.

On 20th October (or November?) 1983 MiG-21MF C50 flown by Lt. Col. Henry Perez was damaged by AA fire over Luena but made it back to base. There were non-combat incidents as well. On 16th March 1976 MiG-21MF C41 piloted by Gen. Rafael del Pino ran out of fuel and force-landed near the very village where Jonas Savimbi had been born; the aircraft was recovered and apparently returned to service. Sister ship C50 was less lucky – it was damaged beyond repair in a crash landing caused by hydraulics failure.

28 MiG-21*bis* are known to have been lost between 1984 and 1994. Presumably most of them were shot down by ground fire, excluding two having known fates: one pilot defected to Namibia in C340, the second aircraft was noted at Luanda as a wreck. Some sources, however, state the day of the first Angolan MiG-21*bis* loss as 5th October 1982 when two such aircraft piloted by Lt. Raciel Marrero Rodriguez and Lt. Gilberto Ortiz Perez crash-landed at Luanda after being hit by South African AA fire (the date of the second accident may be 21st November 1982). A MiG-21bis piloted by Lt. Fidel Perez crashed at Lubango on 29th December 1983. A sister ship flown by Capt. Pausides Hechevaria was lost at Malange on 9th August 1984. Two more examples piloted by Lt. Sergio Herrera and 1st Lt. Raúl Quiala crashed at Lubango on 31st July 1985 and 7th July 1986 respectively, both pilots losing their lives.

Other reported Angolan losses included a MiG-21R flown by Capt. Chacón which crashed at Luena on 21st September 1983. Capt. Andres Valle, Capt. Roberto Hernandez Alvarez and Capt. Guillermo Meriño flying MiG-21s of an unspecified version were shot down and killed at Lubango on 2nd October 1983, 10th November 1983 and 21st September 1984 respectively. Additionally, a MiG-21U flown by pilots Pastrana and Merino crashed at Lubango on 8th December 1982. Another two-seater was shot down by UNITA forces near Luvuei on 28th October 1987; the pilots, Lt. Col. Manuel Rojas and Capt. Ramón Quesada Aguilar, ejected and were taken prisoner.

Congolese Air Force MiG-21*bis* sit in a hangar at Brazzaville. These aircraft saw action in the civil war in that country. ▼

Gerard Gaudin

Congo-Brazzaville Civil War

The Republic of Congo, popularly known as Congo-Brazzaville, was formed from French Central-West Africa on 15th August 1960 and its Air Force was named the *Force Aérienne Congolaise* (FAC).

Pascal Lissouba was democratically elected President of the Republic of Congo in 1992, but his left-wing opponent, former President Denis Sassou Nguesso, refused to accept defeat gracefully and began, with the help of the French oil company Elf-Aquitaine, to recruit a private army known as the Cobras. Tensions built up until, in June 1997, a civil war was sparked off when the Congolese army surrounded Sassou's HQ with the intention of breaking up the nest, an intention that the Cobras forcibly resisted. In the battles that were fought in the capital, Brazzaville, air support was supplied to both sides – mostly in the form of helicopters flown by mercenaries. After the intervention of the Angolan army in early October 1997, fighter aircraft were used in support of the rebels. Six Angolan Aero L-39ZOs were reported to be there, as well as some 'MiGs'. At first it was believed the MiGs were MiG-21*bis* variants but later accounts confirmed them to be MiG-23MLs. Surprisingly, for some unknown reason, the MiG-21*bis* of the *Force Aérienne Congolaise* did not intervene; either the aircraft were not operational or, conceivably, its personnel were waiting to see which side was to be the likely victor. The appearance of the Angolan army and air force proved decisive; in mid-October President Lissouba resigned and was succeeded by Sassou Nguesso.

Algerian Civil War

Islamist extremists started a civil war in Algeria in 1991. It was precipitated by the government's cancellation of the election after fearing that the Islamic Salvation Front (FIS) party, which won the first round, would not uphold the concepts of democracy. There were many different Islamic groups involved in the war, frequently fighting among themselves. The Armed Islamic Group (GIA, *Groupe Islamique Armé*) was especially notorious for killing civilians, threatening to kill not only anyone voting for its opponents but also all foreign residents in Algeria. No details of MiG-21 activities in this conflict have been released. However, it would be very surprising if MiG-21 fighter-bombers were not used to attack rebel groups in the countryside as the war officially continued until 2002, although small scale fighting still continues.

The Christmas War between Burkina Faso and Mali

The war was triggered by Burkina Faso (formerly Upper Volta) and Mali, both claiming ownership of the Agacher Strip, a 100-mile long piece of land located in north-eastern Burkina Faso, known to contain considerable amounts of mineral resources and natural gas. The first clash on 25th November 1974 was a very low-key affair, involving small arms fire between small groups. It was stopped in early 1974 when the Organisation of African Unity offered to mediate. Negotiations continued until 1985 when, after the 1982 revolution in Mali had produced a more aggressive government and the Burkina Faso Army had garrisoned a force there, the Malian Army invaded the strip on the night of 25th December 1985. The only report of air activity was a strike on the marketplace in Ouahigouya by a Malian Air Force MiG-21MF killing about 100 civilians. A truce was agreed on 30th December 1985 and the dispute was referred to the International Court of Justice which on 22nd December 1986, split the 1,150 square miles of disputed territory roughly equally, giving Mali the western portion and Burkina Faso the eastern.

African Aviation Slide Service

▲ **A pair of Mali Air Force MiG-21*bis* fighters. The type was involved in the war with Burkina Faso in 1985.**

Madagascan Insurgents

There are stories in circulation that the Madagascan Air Force was used to attack insurgents. If they are correct, then it is highly likely that MiG-21*bis* fighter-bombers were used against them but no records can be found.

Mozambique Civil War

After Mozambique became independent of Portugal on 25th June 1975, FRELIMO (*Frente de Libertação de Moçambique*, Mozambique Liberation Front), the largest of the groups

via Internet

◄ **The remains of a Mali Air Force MiG-21*bis* shot down by Burkina Faso troops.**

via Internet

▲ **'138', a Madagascan Air Force MiG-21*bis* (*izdeliye* 75B), sitting unserviceable at Tananarive. The type was probably involved in counter-insurgency operations in Madagascar.**

fighting for independence, took over the government of the country. FRELIMO was effectively communist and in addition to economic mismanagement, gave succour and help to guerrilla groups opposing the governments of South Africa and Rhodesia. A civil war began in 1977 with the RENAMO (*Resistencia Nacional de Moçambique*, Mozambique Resistance Movement) rebels, which were supported by South Africa and Rhodesia (until it became Zimbabwe). The USA also supported the rebels until disenchanted by their atrocities and the use of child soldiers. At first, the rebels thrived, with government forces fully occupied with SADF and Rhodesian Army attacks and air raids; South African and Rhodesian insurgents had set up training camps and supply dumps in Mozambique. The situation began to improve when Rhodesia became Zimbabwe in 1980; its new government was formed from the rebels Mozambique had helped in the recent past. More military aid came from the USSR and China and the arrival of 48 MiG-21bis complete with Cuban pilots and ground staff in early 1982 boosted resources; first strikes against RENAMO assets were reported to have taken place in May 1982. Nonetheless, RENAMO was becoming very successful, making renewed attacks on the railway linking Beira with Zimbabwe, but they overstepped the mark by cutting the Beira-Mutare oil pipeline in January 1983. Zimbabwe reacted strongly by sending three army battalions to police vital communications. There are no reports of the involvement of the Zimbabwe Air Force, presumably because it was being reorganised.

via Internet

▶ **Camouflaged Federal Nigerian Air Force MiG-21MFs and a silver-painted MiG-21US at Abuja.**

By 1985, Mozambique was becoming desperate at its lack of success in smashing the insurgency and appealed to Zimbabwe for more help. About 12,000 troops were sent to spearhead an attack on RENAMO's HQ at Casa Banana; the force included 2,000 paratroops, who were dropped near the town to capture the airfield. MiG-21*bis* and MiG-17 fighter-bombers blasted the rebels and after fierce fighting, the area was pacified. The rebels claimed to have shot down several aircraft, including a MiG-21*bis*, but these claims were never confirmed. The insurgents withdrew and regrouped into smaller sections, making detection more difficult. The war continued with Zambian, Malawi and Tanzanian troops becoming involved and more sophisticated counter-insurgency (COIN) tactics being employed with closer cooperation between ground troops and attacking aircraft. Detachments of Zambian and Tanzanian MiG-21MF fighter-bombers were reported to have been employed but no details are known of their exploits.

Following the death of senior government officials when a bomb exploded on a Tu-134 while in flight, a new regime instituted a series of economic reforms that led ultimately to a negotiated peace on 15th October 1992 with a UN peacekeeping force based in the country for the next two years.

Nigeria

No MiG-21s were used in the Biafran civil war of 1967-69, but Federal Nigerian Air Force MiG-21MF fighter-bombers were reliably reported to have delivered several strikes against targets in Chad in the mid-1980s. No further details have been released.

Ogaden War – Somalia against Ethiopia

After the overthrow of Emperor Haile Selassie of Ethiopia in September 1974, the country was in a chaotic state for several years and Somalia decided to take advantage of this apparent weakness to annex the Ogaden. With a large Islamic Somali population, the Ogaden was a province of Ethiopia bordering on Somalia and an insurgency had developed to such an extent that by May 1977 rebels controlled several towns. The incursion by the Somali Army began on 13th July 1977 and by the end of the month 60% of the Ogaden was occupied. A maximum of 45 MiG-21MF fighters and ten MiG-21UM

via Internet

via Internet

▲
The remnants of the Somalian Aeronautical Corps at Mogadishu International Airport, including several MiG-21MFs. An American soldier examines the non-airworthy fighters.

trainers had been delivered to Somalia from 1974 and, after attrition had taken its toll, historians estimate that about 30 MiG-21MFs, some with Iraqi and Syrian pilots, took part in the invasion. Their Ethiopian opponents used Northrop F-5A Freedom Fighters, mostly flown by Israeli volunteers. These aircraft had an inferior performance to that of their opponents but their AIM-9J Sidewinder missiles outclassed the Somalians' R-13s.

One incident occurred when four MiG-21MFs loaded with bombs and without AAMs were surprised by two F-5As that destroyed two, one with cannon fire and the other with a missile. The Israeli pilots watched with amazement as the two remaining MiGs collided and crashed whilst trying to avoid another missile.

The Soviet Union, while supplying arms to both sides, persisted in negotiating a ceasefire. At the pinnacle of his Army's success the Somali President, incensed that his troops were being halted in their advance by an enemy with Soviet-supplied weapons, expelled 6,000 Soviet advisors, demanding that they leave by 13th November 1977. As a result of the threat, Soviet aid to Somalia was discontinued and that to Ethiopia appreciably increased. A massive airlift of arms and aircraft was set in motion on 25th October with Cuban pilots and over 10,000 soldiers following. The reinforcements arrived in the nick of time just as the Somalis launched their final assault on 28th November. The battle to capture Harar was gaining momentum and on 3rd February, the Ethiopians launched their counterattack. A series of ferocious air strikes by Cuban-flown MiG-17 and MiG-21MF fighter-bombers supported the Ethiopian army, now reinforced by 6,000 Cuban soldiers, which attacked the Somalis who were relentlessly driven back. On 9th March 1978, the Somali leader ordered his forces to withdraw, the last unit leaving Ethiopia on 15th March. This last action signalled the end of the Ogaden War.

As far as can be ascertained in this remote region, Somalian MiG-21MFs claimed eight 'kills'; four of the victims were Ethiopian Air Force (EtAF) MiG-21MFs, one a BAC Canberra and three Douglas DC-3s. The Ethiopians claimed 11 'kills' (ten Somalian MiG-21MFs and one MiG-17), all scored by F-5As with Israeli pilots.

It is interesting to note that the last Ethiopian aerial victory was on 3rd August 1977; presumably the EtAF had then decided to concentrate on ground attack.

Sudan Civil Wars

In 1899, Sudan became a British and Egyptian co-dominium and was administratively divided into north and south, the north being predominantly Muslim and the south Christian and Animist. There had long been strife between the Christians and the Muslims, which had erupted into civil war many times over the centuries and, anticipating that Sudan would soon become an independent country, civil war flared up again in 1955. After the Sudan became independent on 1st January 1956, both sides fought for predominance in what became known as The First Sudan Civil War.

In 1968, the Sudanese Government signed an arms deal with the USSR. One of the results of this contract was the delivery to the Sudanese Air Force (SuAF) in 1970 of 18 MiG-21PFs (*izdeliye* 76A) and two MiG-21Us (*izdeliye* 66-600), followed by 18 MiG-21Ms and four MiG-21USs in 1971. The first task for these fighters, stationed at Wadi Sayyidna, was to attack airfields in Ethiopia with the aim of putting a stop to the shipment by air of arms to the rebels in Southern Sudan. Most of the aircrew for the MiG-21PFs was Sudanese and their lack of experience, together with the desert conditions, meant that many MiGs did not survive the next five years, particularly after the Soviets stopped supplying spares when their technical support staff was expelled. President Nimeiry had sur-

vived a communist coup in 1971 and subsequently decided to align Sudan with the West.

On 20th September 1972, five Libyan C-130H transports ferrying about 400 troops to Uganda were intercepted by MiG-21s and forced to divert to and land at Khartoum. Permission was given for them to return to Libya but on taking off they flew without hindrance to Uganda.

Sustained efforts by the World Council of Churches to mediate a ceasefire were finally successful and the Addis Ababa Agreement of 1972 was signed, giving the South a measure of regional autonomy.

Although there was peace in the Sudan, the African continent suffered a succession of droughts, which caused the terrible African famine of the 1970s. The people in the Darfur Region in Western Sudan accused the government of neglecting their needs, and as a result the area of unrest expanded.

Further problems arose in 1981 after Libya invaded Chad and bombed Sudanese towns and villages, where it was believed Chadian soldiers had taken refuge; the onslaught culminated with an attack on Omdurman where many civilians were killed and houses destroyed. Immediately, Egypt responded by sending a squadron of F-4Es to an airfield near its border with Sudan and the USAF transferred to Egypt eight F-15Cs and a Boeing E-3A Sentry AWACS to discourage Libya from invading the Sudan. One of the reasons for the swift external response was the poor state of the SuAF MiG-21s: only eleven MiG-21 fighters and three trainers had survived out of the 42 delivered and only half of them were airworthy.

Second Sudan Civil War

Open rebellion broke out in 1983 after the Muslim government tried to reduce the South's autonomy and the Sudan People's Liberation Army (SPLA) was formed in May 1983. Fighting became fiercer when the Government totally abrogated the Addis Ababa Agreement and imposed Sharia Law on the Christian South. Ethiopian transport aircraft were still able to continue supplying the rebel army, the Sudanese radar cover being insufficient to monitor the whole area.

In spite of the delivery of ten BAC Strikemaster Mk 90s, ten F-5Es and two F-5Fs in the early 1980s, the remaining MiG-21Ms were extensively used as fighter-bombers against the SPLA, which possessed no aircraft but did have Strela (SA-7) MANPADS.

To make good its losses, ten Chengdu F-7A fighters and two Guizhou FT-7 trainers arrived in 1986-87 but attrition was high and so in addition to these deliveries 12 MiG-23BN strike aircraft were sent by Libya in 1987 to help defeat the rebels in the South. By 1992 there were still seven MiG-21Ms and two MiG-21USs in service but another two MiG-21Ms were lost in 1996.

By the end of the century all MiG-21s were out of use, many abandoned on airfields, their role being undertaken by a consignment of 22 second-hand F-7Ns from Iran in 1997 topped up by six new F-7Ns in 1998.

At one stage the government gave arms to local tribesmen and in Darfur even recruited a private army known as the Janjaweed which, assisted by the Sudanese Air Force, aimed to bring the area under control. The result has been worldwide publicity and condemnation for the atrocities inflicted upon civilians.

Neither side was able to win a clear-cut victory and the war was further complicated by the development of oil production from the Bentiu Fields in 1998. The refinery and its pipelines provided a new and easy target for rebels and an extended area for government forces to patrol. However, the government now had more hard currency available from oil exports to buy up-to-date equipment and began to replace the F-7 fighter-bombers with MiG-29s in 2004.

The superpowers, worried by the famine, the fighting and no doubt the possible loss of oil supplies, put pressure on both sides for a ceasefire. The outcome was the Nairobi Comprehensive Peace Agreement signed on 9th January 2005, which granted Southern Sudan autonomy for six years, to be followed by a referendum on its independence.

Ugandan Wars to remove Idi Amin

Shortly after he seized power from President Obote in 1971, Idi Amin imposed a reign of terror on political opponents with the result that 20,000 refugees fled to neighbouring Tanzania. In September 1972, Amin expelled most of the 50,000 people of Asian origin living in Uganda, confiscating their property, the greater part of which filled the pockets of the army. In the interim, Obote had occupied himself by organising a resistance movement in Uganda and obtaining arms. Seizing the moment, he, with the refugees in Tanzania and the new resistance group, invaded Uganda on 17th September 1972.

The expectation that their fellow countrymen would rise up against the dictator and support the insurgency was mistaken. There was no uprising and, at Amin's request, the Libyan

government sent 3,000 troops and reportedly a few Mirage 5D fighters to quell the rebels. Bolstered by this show of strength, the Ugandan Army, supported, by MiG-17 and MiG-21MF fighter-bombers, attacked the insurgents on 20th September and forced them back over the border. Appreciative of the help received from Libya, Amin declared Uganda to be an 'Islamic Republic', even though 85% of its inhabitants were Christian. Shortly afterwards, the Palestine Liberation Army was encouraged to build a base in Uganda and when an Air France Airbus A300B4-203 (F-BVGG) flying from Tel Aviv to Paris was hijacked to Entebbe IAP on 27th June 1976, refuge was given to the hijackers and their 268 hostages. Demands were sent to the Israeli government for the release of 53 PLO prisoners in return for freeing the hostages. Playing for time to organise a rescue attempt, the Israelis entered into negotiations with the hijackers.

At 15.30hrs on 3rd July, four IDF/AF C-130H transports and two Boeing 707s (one acting as relay station) took off from Israeli-controlled Sinai. The first Hercules landed at Entebbe disgorging, in addition to Israeli Special Forces, a black Mercedes saloon and several Land Rovers, which formed a convoy simulating Amin's entourage. The ruse was successful, the hostages were freed, the hijackers killed or captured, and 53 minutes after landing the C-130Hs took off again for Israel but not before the four Ugandan Air Force MiG-17s and seven MiG-21MFs on the runways were destroyed by explosives.

Encouraged by the incident, more recruits joined the National Liberation Front of Uganda (NLFU) and rightly fearing an invasion, Amin ordered a pre-emptive strike on Tanzania. To prepare the way, MiG-17 and MiG-21MF fighter-bombers attacked Bakuba on 10th and 11th October 1978, followed by a final attack on 27th October when three waves of aircraft hit a hospital and other buildings, causing appreciable damage. On 1st November, the Ugandan Army invaded Tanzania and soon occupied the area around Kager, slaughtering nearly 10,000 civilians in the process. Once again, air support was given by MiG-21MFs, several of which were later claimed to have been destroyed by Tanzanian AA batteries. Unfortunately, the gunners also nailed one of their own MiG-21MFs.

After a general mobilisation and careful planning, the Tanzanians and NLFU counter-attacked the Ugandan Army and on 20th January 1979 forced it back into its own country. The Tanzanians and their allies continued the pursuit into Uganda, capturing Masaka on 25th

via Internet

◄ **An Ugandan Air Force MiG-21*bis*. Seven sister ships of an earlier model (MiG-21MFs) were destroyed by Israeli commandos during a raid on Entebbe in 1976.**

February and approaching Entebbe by the end of March. In the meantime, a Libyan Tupolev Tu-22B bomber dropped 20 FAB-250 bombs on M'wanza, missing military targets. There was no interception by Tanzanian MiG-21MFs as they were all occupied with ground attack strikes in the area of Kampala. On 7th April, Tanzanians storming Entebbe IAP just missed capturing the dictator, Idi Amin, who had already fled in a Libyan C-130. As a second Hercules was taking off, it was shot down by an RPG-7 rocket-propelled anti-tank grenade. Kampala fell on 11th April and by 3rd June it was all over for Amin.

In addition to the abovementioned seven Ugandan MiG-21MFs destroyed by the Israelis, a further seven were found intact at Entebbe and carried off to Tanzania as war prises. Four more were later noted on a scrap heap.

Congo Wars

The Belgian Congo was to change its name many times in less than forty years. On 30th June 1960, it became the Congo Republic, a name it held until 27th October 1971 when it was officially renamed Zaïre. In 1997 it changed yet again to become the Democratic Republic of the Congo (or Congo-Kinshasa).

The First Congo War blazed from November 1996 when the Banyamulenge, Tutsi people living in Zaïre, were ordered on pain of death to leave the country. They joined forces with Laurent Desiré Kabila who, with help from dissident Zaïrian soldiers, as well as Ugandan and Angolan armed forces, overthrew President Mobutu forcing him to seek refuge in Morocco. Kabila pronounced himself President and changed the name of the country to the Democratic Republic of the Congo. There is no evidence of the use of MiG-21s in this conflict.

The Second Congo War could be said to have started on 14th July 1998, after President Kabila replaced his Rwandan chief of staff James Kabare with a native Congolese. Then, in August 1998, Kabila tried to expel all Rwandan and Ugandan troops from the Congo, the same

via internet

▲ **An Ethiopian Air Force MiG-21*bis* strams its brake parachute on landing.**

soldiers that had helped him to become President. In their fury the men joined forces with local dissidents and the fighting escalated. Consequently, it was not long before Kinshasa came under threat. Kabila successfully appealed to Angola, Chad, Libya and Zimbabwe for help. Stories circulated of Zimbabwean Chengdu F-7 IINs escorting transport aircraft carrying troops into the country but no firm evidence for this has been found. Most historians consider it a case of the F-7 IINs being mistaken for BAe Hawks or SOKO J-21 Jastrebs that were reported to be present. However, Angola is known to have sent six MiG-21*bis* to Kinshasa IAP from where they made bomb and rocket attacks on the rebels. There were many rebel claims for the shooting down of what they said were Zimbabwean MiGs which seemed to have become the generic term for any ground-attack aircraft. More aircraft arrived from Zimbabwe, and Angola sent Sukhoi Su-25s and MiG-23MLs; both countries also supplied helicopters. Rebels claimed to have shot down 18 'Zimbabwean MiGs' by ground fire but, as already stated, none were present and furthermore, only 12 of these fighters were delivered. Obviously, some aircraft were destroyed but the number cannot approach 18. While troops loyal to Kabila succeeded in saving Kinshasa from the rebels, they never totally defeated them.

A United Nations-brokered Lusaka Ceasefire Agreement was signed on 1st August 1999 by the Democratic Republic of Congo, Angola, Namibia, Zimbabwe, Rwanda and Uganda, but regrettably the Congolese rebel faction, the Rally for Congolese Democracy (RCD), refused to sign. Most signatories at one time or another broke the ceasefire even though over 5,000 UN peacekeepers were authorised to monitor it.

After the assassination of Laurent Kabila in January 2001, his son Joseph became President. A plethora of agreements and ceasefires were broken by one side or another until all parties signed the Global and All-Inclusive Agreement on 17th December 2002.

Wars between Eritrea and Ethiopia (also called Abyssinia)

Part 1 – Eritrean War of Independence 1961-1991

Eritrea was predominantly Muslim and part of the Ottoman Empire until conquered and annexed by the Italians on 1st January 1890. Ethiopia is a country with a large Christian population that had an independent existence until also conquered by the Italian Army in 1936. In 1941, British Commonwealth Armies captured and occupied both countries and for a time Eritrea was a British protectorate. The UK gave Ethiopia full sovereignty under the Anglo-Ethiopian Agreement in December 1944.

On 2nd December 1950, by United Nations plebiscite, Eritrea was federated with Ethiopia; not only was the country granted its own parliament but also given representation in the new Federal Ethiopian parliament. Ethiopia now had access to Red Sea ports, for without Eritrea it was land-locked.

In 1961, an Eritrean struggle for independence began and student protests swiftly turned into civil war. Haile Selassie I, Emperor of Ethiopia, repressed the revolt but played into the hands of his enemies by first dissolving the Federation in 1961, then closing down parliament and finally in 1962, declaring Eritrea to be Ethiopia's 14th Province. The Eritrean People's Liberation Front (EPLF) soundly defeated the Ethiopian Army at the Battle of Asmara in January 1974 in spite of attacks by a few North American F-86F Sabre fighters and North American T-28D Trojan COIN aircraft. This victory gave the EPLF control of most its own country. The EPLF claimed to have shot down by ground fire seven EtAF aircraft during the battles.

On 13th September 1974, Haile Selassie was deposed and the country became a communist one-party Republic. For several years the ruling 'Committee' known as the DERG argued about who was to be its permanent leader and in February 1977, Colonel Mengistu Haile Mariam became President of Ethiopia. The country was in chaos and it was some years before the armed forces could be reorganised. In 1977 the EPLF were no doubt pleased when the Somali Army invaded Ethiopia but this attack resulted in massive Soviet aid for Mengistu. The USSR had initially supported Somalia and then for a time, both countries but it finally opted to concentrate on helping Ethiopia. With the help of 16,000 Cuban troops and a massive airlift of guns, tanks and aircraft, Ethiopia finally prevailed and the war ended when the last Somali troops left Ethiopia in March 1978.

The first tranche of aircraft delivered in 1977 by the USSR were Mil' Mi-24A attack helicopters and MiG-17 and MiG-21MF fighters, all manned by Cubans; however, no Cuban soldier fought in Eritrea. Some of the MiG-21MFs joined a squadron of F-86Ds in attacking troop concentrations of the EPLF and helped the army retain use of the Red Sea Ports. When the Ethiopians regrouped, not only the EPLF was their enemy but also the Tigrean People's Liberation Front (TPLF), the Ethiopian People's Revolutionary Democratic Front (EPRDF) and other rebel groups that had proliferated since Mengistu seized power. The reinforced Ethiopian army attacked the EPLF on 15th May 1978 and was partially effective in southern Eritrea, reopening communications to Asmara and Massawa. However, the EPLF was not destroyed and it regrouped to defeat the Ethiopians at Afabet the following year. Attacks by Ethiopian MiG-21MFs and other aircraft continued with the ever-increasing use of napalm bombs but despite the horrors, the Eritreans were remarkably resilient. According to available sources, two Cuban MiG-21MF pilots (1st Lt. Raúl Hernandez Vidal and Col. Benigno Gonzalez Cortéz) were shot down by AA fire over Eritrea; the former pilot lost his life.

What had started as a guerrilla campaign in 1961 had developed into a full-scale civil war in the 1980s with the EPLF now mustering about 50,000 soldiers. The Ethiopians, in spite of a willingness to accept a huge number of casualties in their attacks, were unable to defeat the EPLF. One spectacular success for the rebels was a commando raid on Asmara AB on 20th-24th May 1984 when 16 MiG-21MFs and MiG-23BNs plus six helicopters and ten other aircraft were claimed to have been destroyed.

A second raid took place on 14th January 1986 when an incredible 42 EtAF aircraft, including many MiG-21MFs, were claimed to have been wrecked but most historians assess the actual figure to be much lower. There was no air-to-air combat in the 1980s, the rebels had no aircraft but had access to supplies of SA-7 MANPADS to fend off the strafing MiG-21MFs and MiG-23BNs. These fighters were even used to attack their own tanks and armoured vehicles to save them falling into Eritrean hands after blundering into a trap in a ravine at Adytum from which there was no escape.

The Ethiopian Army mounted attack after attack on the EPLF but none was successful, and in May 1989 many EtAF officers participated in an unsuccessful coup against President Mengistu, who purged the Air Force of dissident elements, grounding it for a time in order to do so. The EPLF received considerable support from Muslim countries but help for Ethiopia was limited to Warsaw Pact countries and Israel. On 30th December 1989 Fidel Castro began to pull his troops out of Ethiopia and shortly after, the USSR stopped military supplies. Between 1984 and 1988 successive droughts brought famine, adding to the worries of the Ethiopian government and the distress of its people. Civilians suffered horrendous deprivation as both sides used famine-aid as a political weapon, but what finally broke the Mengistu regime was its failure to quell Eritrean rebels, a failure that encouraged more and more Ethiopians to join the EPRDF.

Rebel troops finally entered Addis Ababa on 28th May 1991, President Mengistu having fled to Zimbabwe.

The new government imprisoned all EtAF officers above the rank of captain but many pilots flew off into exile, leaving behind only 20 MiG-21BNs and MiG-21*bis*. The Eritreans had captured eight MiG-21 fighters and one MiG-21UM trainer, all of which were returned to Ethiopia. Thus, in 1991 the EtAF was a broken reed and did not effectively recover until 1995, by which time only a small number of MiG-21s were airworthy.

The outcome of the war was the recognition by a new caretaker Ethiopian government of an independent Eritrea after a UN-monitored referendum in April 1993. Shortly afterwards the UN admitted Eritrea to its membership.

Part 2 – Eritrean-Ethiopian War 1998-2003

After the recognition of an independent Eritrea by Ethiopia, the border between the two countries was undemarcated, with several areas remaining in dispute. Such ambiguity could only lead to tension between the two countries, a tension exacerbated when Eritrea introduced its own currency on 28th November 1997. Ethiopia then boycotted Eritrean ports. On 6th May 1998, some Eritrean troops entered the Badme region, a disputed border zone, causing a skirmish between the Eritrean soldiers and the Ethiopian militia and security police. Eritrea claimed that several of its officials had been murdered near Badme and invaded with a large mechanised force, inciting Ethiopia to mobilise its forces. More border incidents took place, each involving successively larger units.

5th June 1998 saw both Air Forces in action when Ethiopian MiG-23BNs attacked Asmara IAP and Eritrean Air Force (ERAF) Aermacchi MB.339FDs bombed Mekelle, the Tigrean

provincial capital. The following day, two MiG-21MFs strafed Asmara and a nearby ERAF base; they encountered heavy anti-aircraft fire that shot down one plane and damaged the second. There followed a two-day interval in Ethiopian air operations to facilitate the evacuation of foreign nationals. Both sides continued fighting along the border; mounting civilian casualties in bombed cities gave rise to a US-brokered agreement stipulating that neither side would attack 'population centres'. Fighting continued but there were no major thrusts by either side until more aircraft were obtained.

Alarmed by the amount of Russian support and the large number of Eastern European 'volunteer' pilots in Ethiopia, the President of Eritrea made the dramatic announcement that any mercenaries shot down and captured in his country would be beheaded. Russian help provided to the Ethiopians included the refurbishment of about a dozen MiG-21MF or MiG-21*bis* fighters, as well as the supply of ten more MiG-23BNs. By the end of the year, ten Sukhoi Su-27s (including two Su-27UBs) and several hundred R-27 missiles of various types had been supplied. Work was put in hand immediately to allow the MiG-21MF to carry the R-27PS version of the new missiles. Additionally, Russian General Yanakov was put in charge of the EtAF.

For its part, the ERAF having been refused any assistance by Russia, purchased ten MiG-29s (including two MiG-29UBs) from the Ukraine. The stage was now set for the next round of heavy fighting which began in February 1999. Operation Sunset was EtAF's contribution and on 25th February two MiG-23BNs escorted by Russian-flown Su-27s were strafing Eritrean positions when they were intercepted by two MiG-29s of 5 Squadron ERAF, both of whom were destroyed by R-73 missiles after a lengthy tussle; one MiG-23BN crashed after being hit by two Eritrean R-27R missiles.

The following day, two MiG-21MF/bis and a MiG-23BN fighter-bomber were strafing Eritrean positions when an ERAF MiG-29UB shot down both MiG-21s with R-73 missiles. In return they were bounced by two Su-27s whose missiles failed to make a direct hit but the two-seater inexplicably disappeared and has not been seen since. If the kill could be confirmed it would be the first time a female pilot, Captain Esther Tolossa, had destroyed an enemy jet fighter in aerial combat. As a result of these engagements the EtAF gained and retained mastery of the air. A belated attempt to turn the scales took place on 18th March after the EtAF launched Operation Westwind. EtAF MiG-21MF and MiG-23BN fighter bombers were attacked by ERAF MiG-29s, one of which exploded after the escorting Su-27s intervened. The intensive ground attack operations by the EtAF incurred significant losses – not only to ground fire but also as a result of the wear and tear imposed by desert operations. The use of imperfectly trained pilots also played a role, as one example illustrates; a MiG-21 fighter under the control of one of these pilots hit an electricity pylon on 20th April 1999 and crashed onto a suburb of Arba Minch, killing eight civilians and injuring 14. Both sides recognised the need to take stock and rest their weary troops so the war entered a relatively quiet period.

Refreshed and re-armed, the Ethiopian Army launched its final offensive, codenamed Operation Hard Wind, in May 2000 with new supplies of guns, tanks and aircraft; an addition to the EtAF inventory was the delivery of eight Sukhoi Su-25T dedicated anti-tank aircraft. On 18th May, two EtAF MiG-21MFs or MiG-21*bis* were intercepted by an ERAF MiG-29 pilot who, having missed with his missiles, shot one down and damaged the other with his 30-mm cannon. The action was spotted by two EtAF Su-27s, only one of which could retaliate, the other being severely damaged by a collision with a buzzard and whose main priority was to return to base; the remaining Su-27 dispatched the ERAF MiG-29 with his R-73 missiles. The new offensive, instead of employing the usual frontal attack, went round the Western flank of the Eritrean defences and, having broken through and appearing to be attacking Agordat, suddenly wheeled east towards Areza to link up with an attack on Adi Quala. Only resolute Eritrean counter-attacks saved the day but militarily the Ethiopians were in a strong position. The only reason for their failure to administer the coup de grâce was the fear of offending the international community by appearing to annex the whole of Eritrea rather than being satisfied with only the disputed border territories.

For some time the Organisation for African Unity, the European Union and Libya had been trying to arrange a ceasefire and both sides, exhausted by the war, agreed on 18th June 2000. A Temporary Security Zone 25km (15 miles) wide was established within Eritrea, enforced by United Nations peacekeeping forces; finally, on 12th December 2000 the two governments signed a Peace Agreement. Neither side, especially Ethiopia, is happy with this agreement, so peace in the region remains a very fragile affair.

PART TEN

FACE TO FACE WITH THE ADVERSARY

When designing the second-generation jet fighters, aircraft designers gave the main priority to obtaining the highest possible speed and service ceiling, and to providing the fighter with state-of the-art avionics, equipment and potent armament. In the course of the 1950s the American aircraft designers developed the McDonnell (later McDonnell Douglas) F-4 Phantom II multi-role fighter, the Convair F-102 Delta Dagger and F-106 Delta Dart high-speed interceptors, as well as the Lockheed F-104 Starfighter light tactical fighter; later these were supplemented by the Northrop F-5 Freedom Fighter (aka Tiger) fighter-bomber.

The Starfighter's aerodynamic layout was optimised for obtaining high speeds and altitudes, as well as a high rate of climb. The fighter had very high performance: its rate of climb at sea level was 244 m/sec (48,034 ft/min); the top speed at sea level reached the record figure of 1,590 km/h (988 mph), the top speed at altitude being 2,260 km/h (1,405 mph). A world altitude record established on this machine was 27,812 m (91,250ft). However, the F-104 did not have sufficient manoeuvrability for conducting close air combat; for this reason it was built in series primarily as an interceptor, or as a multi-purpose fighter-bomber, or as a reconnaissance aircraft. The machine was difficult in handling, especially at subsonic speeds and during the landing. In the years when the F-104 was in service with the West German Air Force (Luftwaffe), 139 flight accidents were recorded per 100,000 flight hours – a very high rate. One more aircraft – the F-5A Freedom Fighter – was developed as a relatively cheap and simple supersonic fighter-bomber with a limited air combat capability (85% of its operational use was supposed to be close air support of ground troops, air combat accounting for only 15%).

In the Soviet Union the main attention in the second part of the 1950s was devoted to the development of interceptors – the Sukhoi Su-9 and Su-11, the Lavochkin La-250, the Mikoyan I-75, Ye-150, Ye-152 and others. These machines had high flight speeds and attained a service ceiling of 18,000-20,000 m (59,040-65,600 ft); they were equipped with radars and armed with medium-range AAMs. It was at that time that OKB-155 led by Mikoyan developed the MiG-21 – a lightweight aircraft, simple in design and posing no production problems, which initially was also optimised for intercepting aerial targets. This machine embodied the best qualities of its predecessors – the MiG-15, MiG-17 and MiG-19 fighters: high speed and altitude performance and good manoeuvrability coupled with being relatively cheap in production. The new aircraft attained a maximum speed of 2,175 km/h (1,352 mph), equivalent to Mach 2.05, at altitude; its rate of climb at sea level was 130 m/sec (25,590 ft/min), with a service ceiling of 19,000 m (62,320 ft). The main deficiencies were the absence of a good

Performance comparison of second-generation fighters

	MiG-21F-13	Dassault Mirage IIIC	Lockheed F-104G	SAAB J-35D	Northrop F-5A
Wing span	7.154 m (23 ft 5 21/32 in)	8.2 m (26 ft 10 53/64 in)	6.68 m (21 ft 11 in)	9.4 m (30 ft 10 5/64 in)	7.7 m (25 ft 3 1/32 in)
Length	15.76 m (51 ft 8 15/32 in)	13.83 m (45 ft 4 31/64 in)	16.69 m (54 ft 9 5/64 in)	15.35 m (50 ft 4 21/64 in)	14.40 m (47 ft 2 29/64 in)
Wing area, m² (sq ft)	23.0 (247.3)	34.1 (366.6)	18.28 (196.55)	49.2 (529.0)	15.79 (169.78)
Engine thrust, kgp (lbst)	5,740 (12,650)	6,200 (13,670)	7,167 (15,800)	8,000 (17,640)	2 x 1,850 (2 x 4,080)
All-up weight, kg (lb)	7,100 (15,650)	11,800 (26,010)	9,510 (20,965)	11,400 (25,130)	6,080 (13,400)
Maximum speed, km/h (mph)	2,125 (1,319)	2,220 (1,378)	2,120 (1,316)	2,100 (1,304)	1,487 (923)
at an altitude of, m(ft)	12,300 (40,350)	12,000 (39,370)	12,200 (40,030)	11,500 (37,730)	n.a.
Speed at sea level, km/h (mph)	n.a.	1,490	1,470	1,400	n.a.
Service ceiling, m (ft)	19,000 (62,335)	23,000 (75,460)	17,680 (58,005)	16,700 (54,790)	15,400 (50,525)
Range, km (miles)	1,580 (981)	650 (403)	819 (508)	635 (394)	n.a.
Armament:					
cannons	1 x 30 mm (1.18 cal.)	2 x 30 mm (1.18 cal.)	1 x 20 mm (.78 cal.)	2 x 30 mm (1.18 cal.)	2 x 20 mm (.78 cal.)
AAMs	2	2	4	4	2

radar, unsophisticated avionics and insufficient range. Guided by the wish to eradicate these deficiencies, the Mikoyan OKB developed a whole series of versions of the MiG-21. They featured more advanced radio and navigation equipment and could carry a wider range of weapons. The aircraft became heavier, but in practice its stability, controllability and manoeuvrability characteristics did not deteriorate appreciably as compared to the baseline version, because the powerplant underwent a simultaneous process of improvement.

The table on the opposite page presents comparative performance characteristics of the early production version of the MiG-21 and its counterparts abroad.

Local wars which had erupted in the Middle East, in Africa and in South-East Asia in the 1960s and 1970s completely disproved the concept of air combat as a one-shot 'missile duel' ('first shot, first kill') which was upheld by Soviet military theoreticians. It became clear that dogfighting remained the main kind of struggle for air superiority. Thus, Soviet specialists finally grasped, albeit with some delay, that the main assets of a fighter were its manoeuvrability and efficiency of its weapons complement. Practical experience revealed many deficiencies of multi-purpose combat aircraft (remember, we are speaking of the 1960s and 1970s); in consequence, military customers found it expedient to concentrate efforts on the development of aircraft dedicated to a given mission type. Their design, performance, equipment and armament, as well as the training of flying personnel, would have to be optimised for one specific type of tasks.

Especially much information for research and analysis was provided by wars in the Middle East and in Vietnam where jet aircraft saw the most intensive use. It came as a surprise to Western military experts that the MiG-21, which was less potent with regard to avionics and armament but lighter and more manoeuvrable, successfully opposed the mighty Phantoms and Republic F-105 Thunderchief fighter-bombers used by the USA. The MiGs could also oppose the Mirages on equal terms.

In the course of air battles Soviet military advisors, aviation specialists and pilots who were sent to 'hot spots' to render assistance to 'friendly' countries got a unique opportunity to compare in real conditions the strengths and weaknesses of the MiGs and the enemy aircraft opposing them.

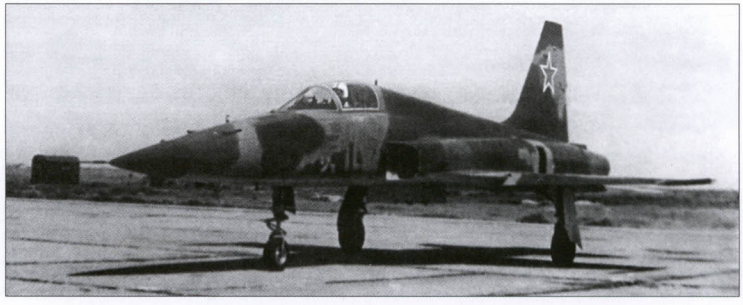
In comparison with the F-4E the MiG-21 was lighter and had a better thrust/weight ratio, which endowed it with a superior rate of climb and, in consequence, in the vertical manoeuvre; the MiGs also had an edge over the F-4Es in acceleration characteristics. The latter circumstance enabled the MiGs to deal a surprise strike against the enemy and to disengage combat quickly, that is, to keep the initiative in air combat (Vietnamese pilots frequently made use of that manoeuvre).

The F-4E, too, had its strong points. The Phantom's large fuel load enabled it to wage combat for a longer time, and the twin-engined layout ensured higher survivability (it should be noted that, due to the small fuel load of the MiG-21, its pilots often had to break off the engagement at a far from opportune moment). The distribution of the workload between the pilot and the weapons system operator enabled the F-4's crew to concentrate on their respective specific tasks. In comparison with the MiG, the F-4 carried a bigger complement of AAMs which, furthermore, comprised both medium-range and long-range missiles. This allowed the Phantom's crew to display greater flexibility in forming the scenario of air combat (we have to point out that the MiG-21s which opposed the Phantoms both in Vietnam and in the Middle East could carry

Detlev Grass

▲
The MiG-21 was the principal Soviet light fighter of the 1960s and early/mid-1970s. Illustrated here is a MiG-21bis.

No, this is not an aircraft operated by a US Air Force 'aggressor' squadron; F-5E 73-00867 was supplied to the Soviet Union by Vietnam and evaluated at GNIKI VVS.
▼



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F-5E '10 Red' (73-00867) is prepared for a test mission at Akhtoobinsk.

GNIKI VVS test pilot Nikolay I. Stogov (left) receives a briefing.
▼

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only two missiles with IR seeker heads). Also, the avionics of the US aircraft were considerably superior to those of the Soviet machine.

As for the Mirages, they were also surpassed by the MiGs in vertical manoeuvre; it was noted that when the Mirages were chasing the MiGs while gaining altitude at high angles of attack, they were prone to inlet stalls with ensuing engine surge. On the other hand, the Mirages had superior performance during horizontal manoeuvres. The Soviet pilots who fought on the Egyptian side even coined a proverb which can be rendered thus: 'When a Mirage is in sight, avoid a dog-fight' (in Russian, the word Mirage rhymes with the word ***virazh***, 'banking turn', which had to be avoided). However, in horizontal manoeuvres, too, cases were noted when the fighters of French design suffered engine surge when performing banking turns with a small radius. This was due to the inherent design peculiarities of single-engined aircraft with lateral air intakes (when they executed manoeuvres of that kind, there arose a very pronounced difference in the airflow speed in the port and starboard air intakes, resulting in engine surge).

It was precisely the high efficiency of the agile light fighters that led aircraft designers the world over to take a fresh look at the degree of importance of the various performance characteristics that would ensure preponderance over the enemy. Specialists undertook thorough theoretical studies and produced mathematical models of an air combat, trying to evolve

forecasts as to the future development of the aerial combat tactics. All this resulted in the emergence of a formula of combat efficiency of a fighter, which, however, is empirical and does not give a qualitative assessment. This formula boils down to the ratio between the probability of shooting down the adversary and the probability of being shot down (given the parity of the initial conditions under which the aircraft begin the engagement).

The authors of this book did not consider it their task to present and assess from their own point of view the numerous 'theoretical deliberations' about the superiority of this or that type of aircraft in air combat which, of late, are cropping up with a growing frequency both in aviation literature and in the Internet. Likewise, few would contest the assertion that the outcome of an air combat is far from being determined by a fighter's performance alone; much depends on the pilot. An experienced pilot in an aircraft with inferior performance can emerge as the victor from air combat with a greenhorn lieutenant piloting an ultramodern fighter. Furthermore, it is fairly difficult to cite precise quantitative data on the number victories and losses of this or that type of aircraft in local wars – the data published in Western and Russian mass media are very contradictory (as are the opinions of many experts, aviation specialists and so on). Nevertheless, in Chapters 8 and 9 the authors have presented certain generalised information concerning the combat employment of the MiG-21.

In this chapter the authors would like to complement the information presented earlier by an interesting fact which to a certain extent will help the reader to form a certain opinion regarding the combat efficiency of the MiG-21.

In 1975, after the end of hostilities in Vietnam, a large amount of US military hardware, including aircraft, had remained in the country as spoils of war. Much of the captured materiel was transferred to the Soviet Union; the items thus obtained included an ex-South Vietnamese Air Force F-5E Tiger II serialled 73-0867 (c/n R.1048), which was manufactured on 2nd June 1974. The fighter was delivered to Chkalovskaya AB east of Moscow where Soviet specialists had their first acquaintance with this aircraft; later it was transferred to the main facility of GNIKI VVS in Akhtoobinsk. A special test team was formed, comprising engineers and technicians of that Institute (specialists on airframe, powerplant, equipment, armament etc.) and test pilots. It was tasked with conducting a thorough study of the fighter, flight-testing it and drawing a comparison with its Soviet counterpart – the MiG-21*bis*.

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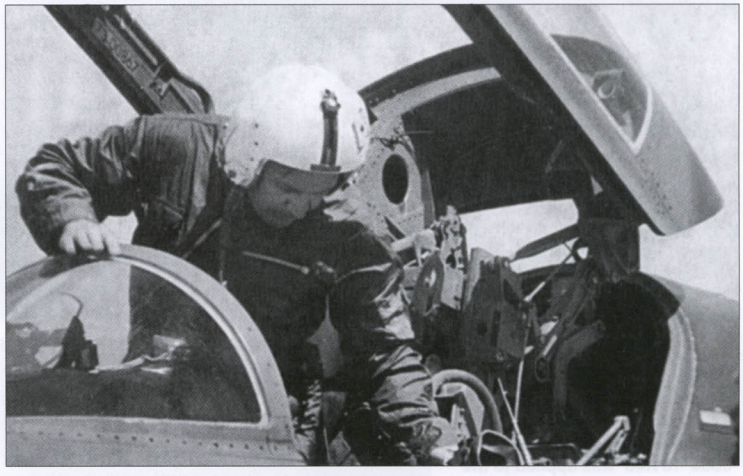

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▲
Nikolay I. Stogov in the cockpit of the F-5E. He did the greater part of the flying on the type at GNIKI VVS.

Here the reader should be reminded of some facts of aviation history.

The MiG-21*bis* was a logical continuation of the preceding MiG-21 versions. It was fitted with a new, more powerful and fuel-efficient engine; the range of weaponry used by the new variant was expanded. All this did not entail any drastic changes in the design as compared to its predecessors.

In the 1960s the USAF had no 'pure' fighters in its inventory. An attempt to produce a Phantom II upgrade making this fighter suitable for dogfighting proved unsuccessful. Despite its high performance, superior thrust/weight ratio, potent armament and up-to-date avionics, this aircraft fell short on manoeuvrability, was complicated in handling and too costly. The F-5

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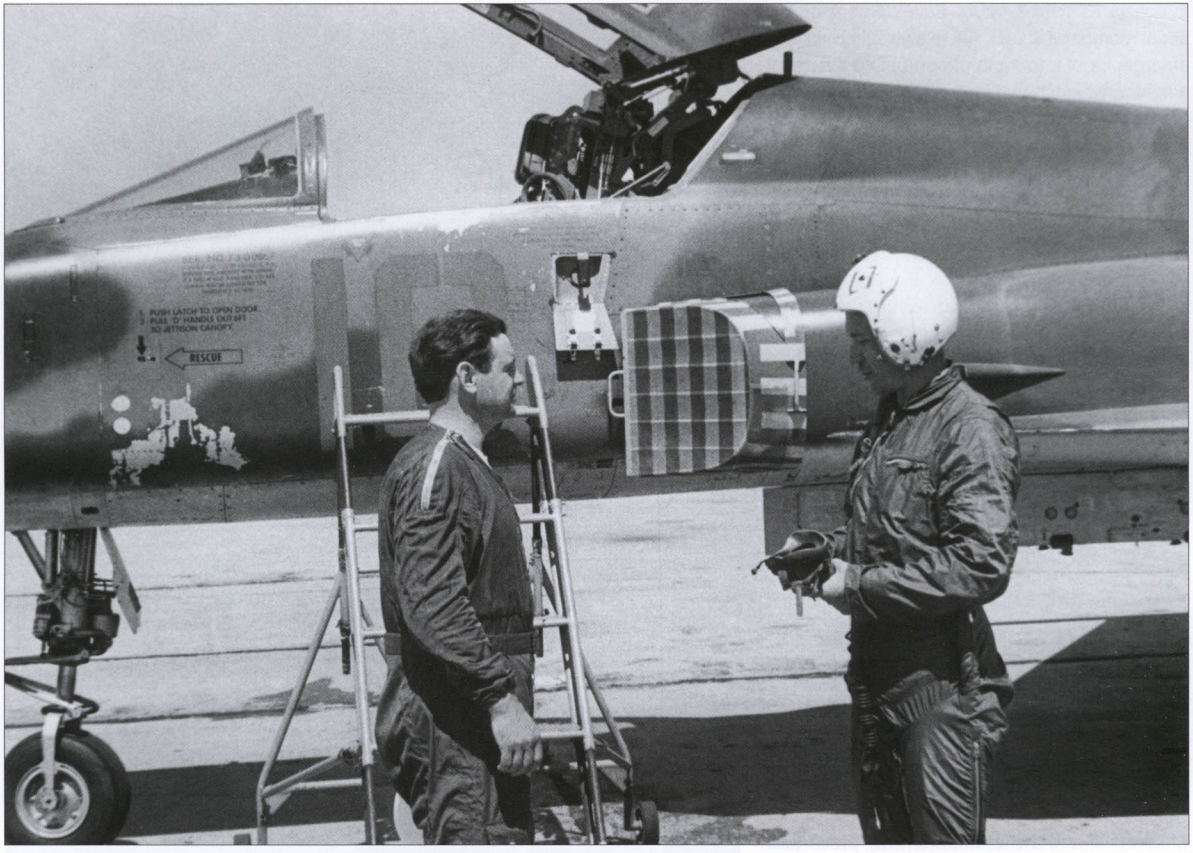

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GNIKI VVS pilots Vladimir N. Kondaurov (left) and Nikolay I. Stogov discuss the F-5E's performance and handling. The code '10 Red' was applied to the fighter in the Soviet Union along with the red stars.

►
Vladimir N. Kondaurov and Nikolay I. Stogov have a dicsussion with a GNIKI VVS engineer.

V.N.Kandaurov archive

proved to be the machine more suitable for the chosen purpose than any other US type thanks to its simplicity, low cost, operational reliability and good stability and control characteristics. Changes introduced into the design of the baseline aircraft were more substantial than those introduced into the design of the MiG-21*bis*.

Modifications incorporated in the F-5E led to a considerable increase in performance over the baseline F-5A. The new fighter had a higher top speed, longer range, a better rate of climb, greater pitch/roll/yaw rates, smaller turn radius and better field performance.

The aircraft was now primarily intended for air combat (which, according to the experts' assessment, would account for 85% of combat operations, while only 15% was allotted for CAS – that is, the distribution of roles was reversed as compared to the F-5A). Northrop specialists succeeded in achieving high commonality between this aircraft and other F-5 versions: 75% of the jigs and tooling, 40% of the spare parts and 70% of the equipment for ground maintenance was identical for the various F-5 versions.

The USA had plans for selling this fighter abroad on a wide scale, and the machine was advertised accordingly. Estimated performance figures, a detailed description of the airframe and the aircraft's systems were repeatedly published in aviation literature long before the commencement of flight testing of the F-5E. The Soviet specialists were not particularly impressed by the available information on this fighter. An opinion prevailed in the Soviet Union that this was just a cheap and well-built supersonic aircraft with average performance and that it would be inferior to the MiG-21*bis* as regards the maximum level flight speed, rate of climb, thrust/weight ratio, wing loading and service ceiling, but would be superior to the Soviet fighter in range, ordnance load and more advanced avionics.

Coming back to the events of 1975-76 in Akhtoobinsk, it must be noted that, summing up the results of the studies of the F-5E conducted on the ground and followed by special ground tests, Soviet technical specialists gave this fighter a very high appraisal. They noted, in particular:

- the ease and simplicity of ground maintenance and mission preparation procedures;
- convenient access to systems and units of the aircraft, its powerplant and equipment;
- the rational location of production breaks and access hatches;
- simplicity of the refuelling procedure;

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◄ **Nikolay I. Stogov, Aleksandr S. Bezhevets and Vladimir N. Kondaurov – all three pilots who flew the F-5E in the Soviet Union.**

- convenience in the maintenance of aircraft systems and armament;
- a good view from the cockpit, a high degree of comfort for the pilot and convenient location of instruments and controls.

It turned out that considerably less time was required for maintenance of the aircraft per flight hour in comparison with all the supersonic fighters that were in the inventory of the Soviet Air Force.

Upon completion of the ground testing stage, flight testing of the F-5E took place between 20th July 1976 and 15th May 1977; its scope was similar to the usual programme of State acceptance trials of Soviet aircraft. The testing was conducted by GNIKI VVS project test pilots Nikolay I. Stogov, Aleksandr S. Bezhevets and Vladimir N. Kondaurov (all holders of the HSU title). Upon completion of the basic flight testing, which resulted in a very high appraisal of the US fighter's performance, the F-5E was pitted against the MiG-21*bis* in mock combat (or the so-called 'joint manoeuvring' in the parlance of the GNIKI VVS personnel). The result was so surprising that not only the military test pilots who conducted these mock combat sessions but the GNIKI VVS scientific staff and the OKB-155 designers as well were in for a rude shock.

Despite its higher thrust/weight ratio and rate of climb, higher G limit and lower wing loading, the MiG-21*bis* never succeeded in 'getting on the tail' of the F-5E in any of the 18 air combat sessions! Conversely, in the majority of the engagements the Tiger II had a real opportunity to attack its adversary from the rear hemisphere.

Here are the remarks made by Merited Test Pilot Col. Vladimir N. Kondaurov, who had taken part in the Soviet evaluation of the F-5E:

- the MiG-21*bis* has better acceleration characteristics and a better rate of climb at speeds in excess of 500 km/h (311 mph) thanks to its better thrust/weight ratio; it also has greater turn rates at speeds in excess of 800 km/h (497 mph);

Comparative performance of the MiG-21*bis* and the Northrop F-5E

	MiG-21*bis*	F-5E Tiger II
Year of first flight	1971	1972
Year of the start of series production	1972	1974
Empty weigh, kg (lb)	5,339 (11,772)	4,390 (9,680)
All-up weight, kg (lb)	8,725 (19,239)	7,100 (15,655)
Maximum take-off weight, kg (lb)	9,750 (21,500)	11,200 (24,696)
Fuel load, kg (lb)	2,400 (5,290)	2,000 (4,410)
Length	15.0 m (49 ft 2¾ in)	14.7 m (48 ft 2¾ in)
Wing span	7.15 m (23 ft 5½ in)	8.13 (26 ft 8 in)
Wing area, m² (sq ft)	23.0 (247.6)	17.3 (186.2)
Wing leading edge sweepback	57°	25°
Powerplant	Tumanskiy R25-300	2 x General Electric J85-GE-21
Maximum dry thrust/afterburning thrust, kgp (lbst)	4,100/7,100 (9,040/15,655)	2 x 2,270/– (2 x 5,005)
Maximum Mach number	2.05	1.64
Maximum speed, km/h (mph)		
at sea level	1,300 (808)	1,270 (789)
at altitude	2175 (1,352)	1,740 (1,081)
Minimum control speed, km/h (mph)	400 (249)	350 (217)
Service ceiling, m (ft)	17,800 (58,390)	16,460 (53,990)
Operational G limit	8.5	7.33
Maximum range without drop tanks, km (miles)	1,210 (752)	1,550 (963)
Maximum thrust/weight ratio with 50% fuel	0.81	0.65
Wing loading with 50% fuel, kg/m2 (lb/sq ft)	380 (79.4)	410 (84.0)
Maximum rate of climb at sea level, m/sec (ft/min)	235 (46,260)	160 (31,500)
Cannon armament	23-mm (.90 calibre) GSh-23 twin-barrel cannon	2 x 20-mm (.78 calibre) M-39 cannons
Ammunition complement, rounds	200	2 x 280
Rate of fire, rpm	3,500	2 x 1,500
Other weapons	4 AAMs, unguided rockets, bombs	AAMs and ASMs, unguided rockets, bombs

The forward fuselage of F-5E 73-00867 survives as a teaching aid at the Moscow Aviation Institute. ▼

via Internet

• at speeds of 750-800 km/h (466-497 mph) neither of the two aircraft has an advantage over the other – the fighting was conducted on equal terms, but no close combat really ensued because of the high turn radius;

• at speeds below 750 km/h the F-5E has better manoeuvrability, and this advantage becomes greater as the altitude is increased and the flight speed is diminished;

• the F-5E has a wider area of manoeuvring in which sustained banking turns can be performed with a radius less than 1,800 m (5,900 ft);

• the F-5E has a better view from the cockpit and a more convenient cockpit layout;

• the F-5E has a bigger ammunition load, but a lower aggregate rate of fire of the cannons, which makes it possible to extend the time of firing.

It turned out that the F-5E's high manoeuvrability at low speeds and high angles of attack was achieved thanks to the use of high-lift devices – wing leading-edge and trailing-edge flaps. Depending on the flight mode and flight speed, the LE and TE flaps are deflected to predetermined angles, thereby the wings acquire an airfoil which is close to being the optimum for the given flight conditions. This is accompanied by an increase of the lift-to-drag ratio of the aircraft (greater lift and lesser drag) in every flight mode, as compared to an aircraft whose wings are not fitted with high-lift devices. This results in improved controllability characteristics at high angles of attack, enabling the pilot to make use of higher permissible G-loads at low speeds and, in consequence, to make turns with a smaller radius and greater angular rate.

Kondaurov wrote about the US fighter: *'While being reluctant to perform vigorous manoeuvres in the cruise flight configuration of the wings (with the high-lift devices retracted), it underwent a transformation when the pilots set it into the manoeuvring configuration…'*

The table on his page illustrates the comparative performance characteristics of the Soviet MiG-21*bis* and the US F-5E (in the latter case, the fighter's technical documentation and the results of the testing at GNIKI VVS are used as a source).

Thus, being able to draw a direct comparison between the two aircraft, Soviet aviation experts were in a position to assess objectively the degree of real combat efficiency of the MiG-21's latest production model and issue amended recommendations on the combat employment of the aircraft, taking into account the information they had obtained on the potential adversary. These recommendations were brought to the notice not only of the Soviet Air Force, but also of a number of friendly countries whose air forces operated the MiG-21.

PART ELEVEN

THE MiG-21 IN DETAIL

Type: Day (MiG-21F/MiG-21F-13) or all-weather single-seat tactical fighter/interceptor with limited strike capability designed for day and night operation in visual meteorological conditions (VMC) and instrument meteorological conditions (IMC); (MiG-21U/US/UM) conversion/proficiency trainer. The airframe is of riveted all-metal construction, with flush riveting on all outer surfaces, and is largely made of D16 duralumin, V25, M25T4 and AK-4-1 aluminium alloys; VM-65-1 and ML5 magnesium alloys are used in some areas, while some highly stressed parts are made of 30KhGSA, 30KhGSNA and EI-643 grade steel. Some non-stressed parts are made of glassfibre reinforced plastic (GRP).

Fuselage: Semi-monocoque stressed-skin structure with frames, longerons and stringers; the fuselage is area-ruled. The cross-section changes from circular to elliptical with the longer axis vertical to circular; the maximum width is 1.242 m (4 ft 0²⁹⁄₃₂ in).

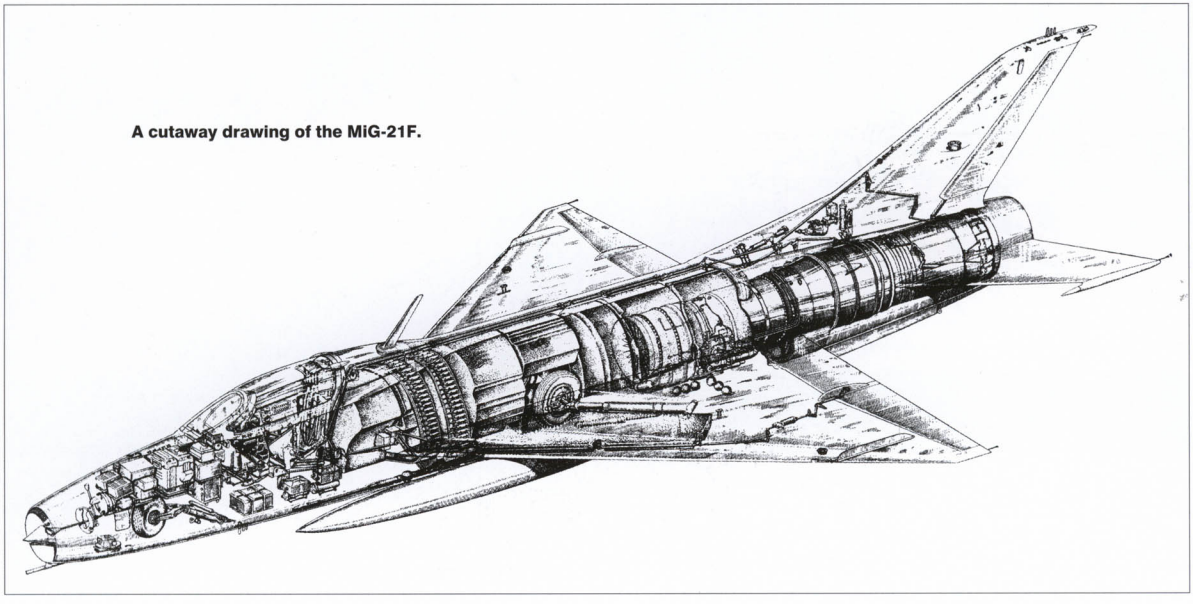
Structurally the fuselage consists of two sections: forward (up to fuselage frame 28/28A, which is the fuselage break point) and rear. The latter is detachable for engine maintenance and removal.

The *forward fuselage* (or rather forward/centre fuselage) has 28 frames, plus longerons and fairly thick skins; the skin thickness is 1.2 mm (0³⁄₆₄ in). The fuselage nose incorporates an axisymmetrical sharp-lipped air intake with a vertical splitter carrying a movable centrebody (shock cone). On the MiG-21F/MiG-21F-13 and the trainer versions the inlet diameter is 0.69 m (2 ft 3⁵⁄₃₂ in) and the multi-shock ogival centrebody with a GRP forward portion houses a simple radar rangefinder.

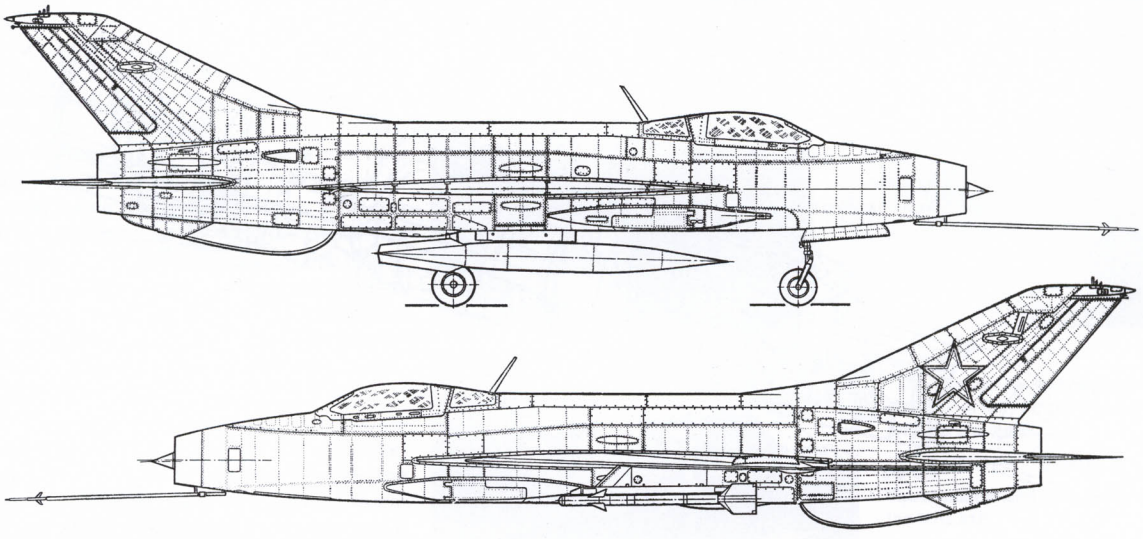
On the MiG-21PF and subsequent single-seat versions the inlet diameter is increased to 0.87 m (2 ft 10¼ in) to accommodate the fire control radar. The much larger centrebody with a GRP front portion enclosing the radar antenna is of simple conical shape; it is 20 cm (7⅞ in) longer and of 0.6 m (1 ft 11⅝ in) greater diameter. The centrebody is angled downward 3° with respect to the fuselage waterline.

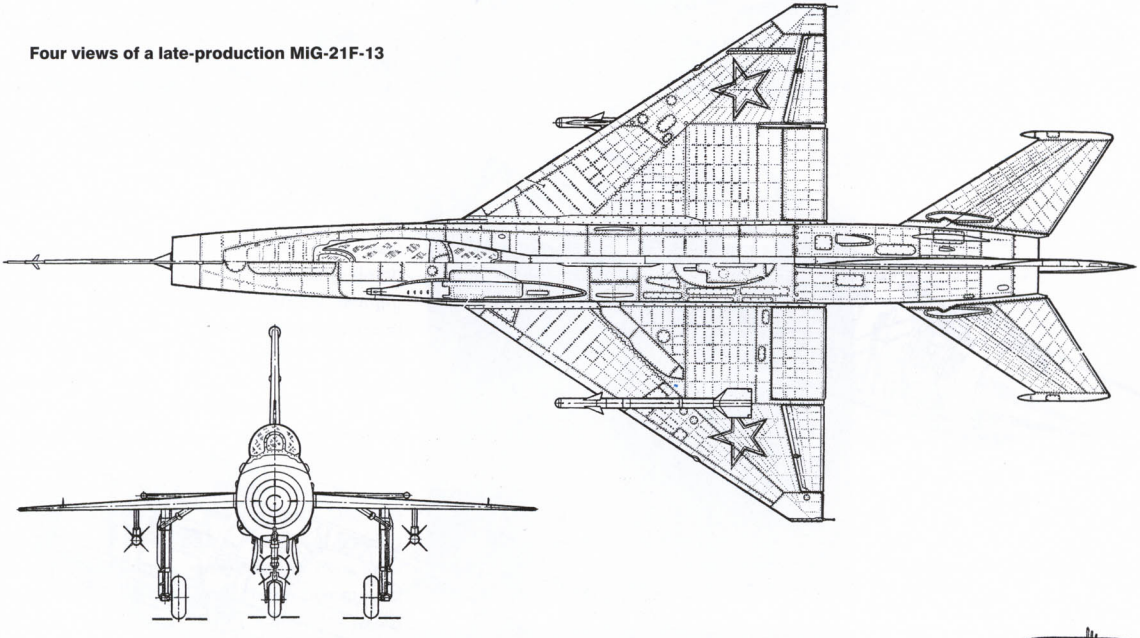
The vertical splitter divides the inlet into two quasi-elliptical section air ducts passing along the fuselage sides, flanking the cockpit(s), nosewheel well and avionics bays. The ducts merge again at frame 22 ahead of the engine compressor face, the inlet duct assuming a circular section. A pair of hydraulically actuated rectangular anti-surge doors is located on the sides of nose between frames 3 and 4; additionally, a pair of spring-loaded auxiliary blow-in doors is provided just ahead of the wing leading edge at frame 10. (See also Powerplant.)

The MiG-21F/MiG-21F-13 has an undernose pitot boom mounted on the centreline. Later versions have a PVD-5 pitot boom mounted dorsally on the centreline; late MiG-21Rs and subsequent versions, as well as all trainer variants, have the pitot offset to starboard to improve the pilot's field of view. A new PVD-7 pitot with pitch/yaw transducer vanes was introduced on the MiG-21SM/MiG-21M. A back-



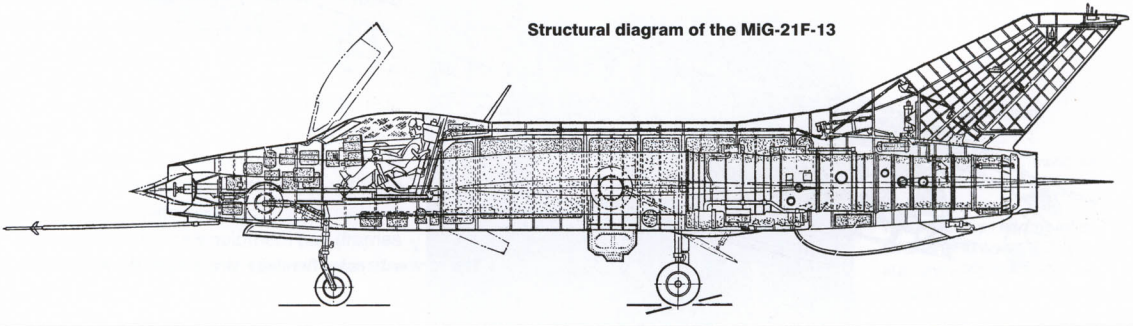
A cutaway drawing of the MiG-21F.



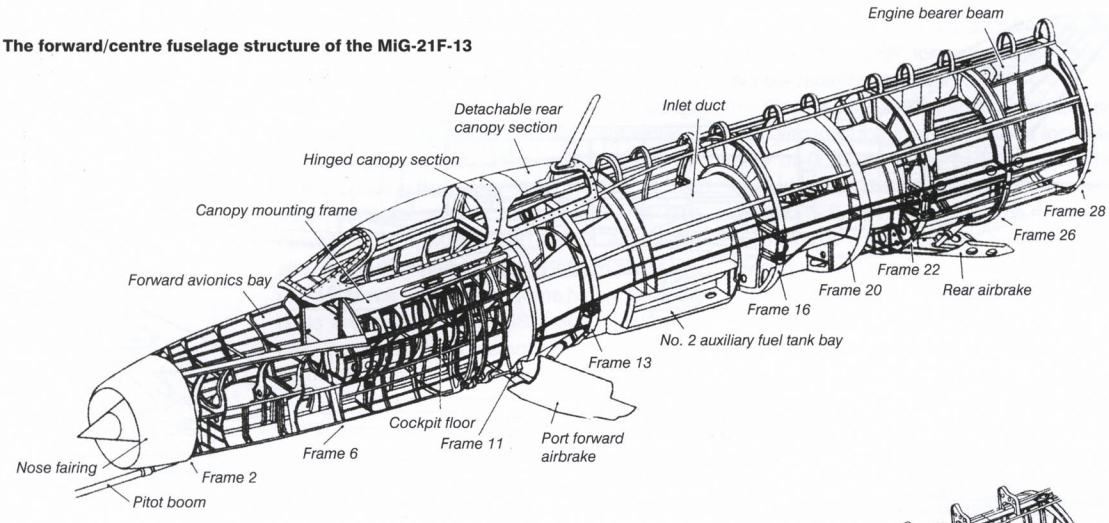


Four views of a late-production MiG-21F-13

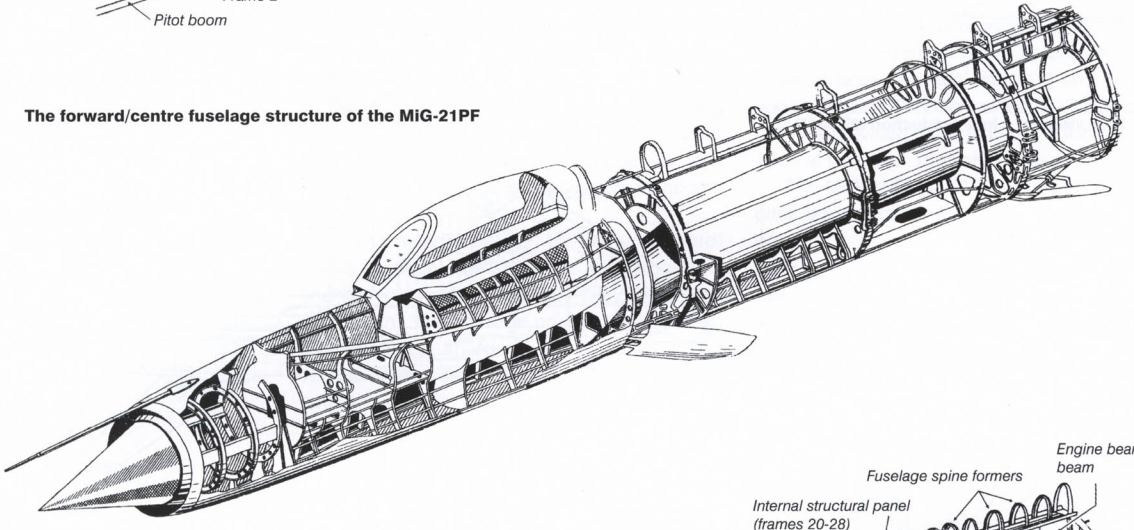
Structural diagram of the MiG-21F-13

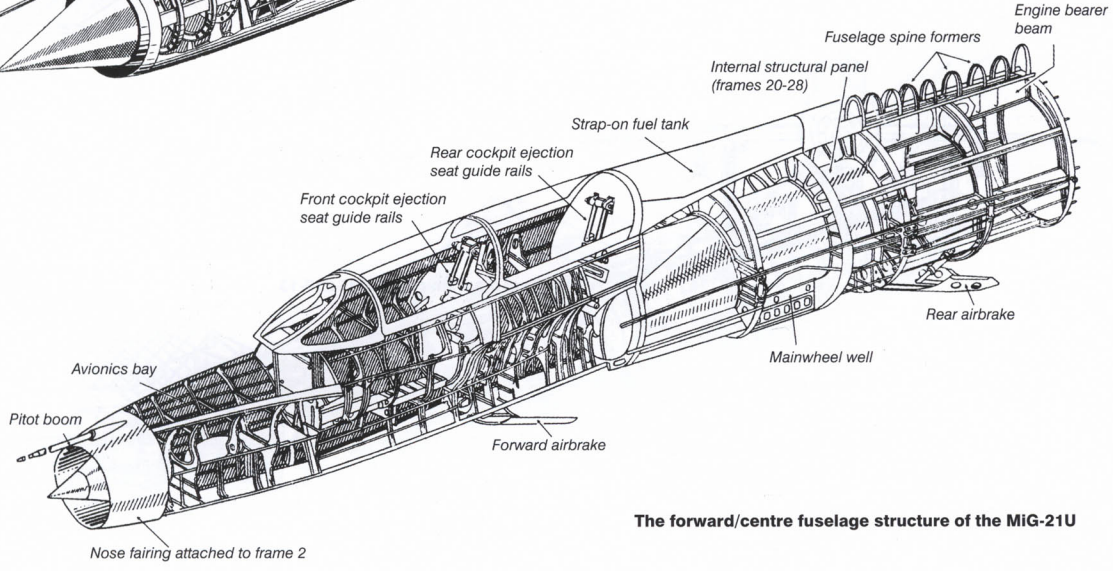


The forward/centre fuselage structure of the MiG-21F-13



The forward/centre fuselage structure of the MiG-21PF





The forward/centre fuselage structure of the MiG-21U

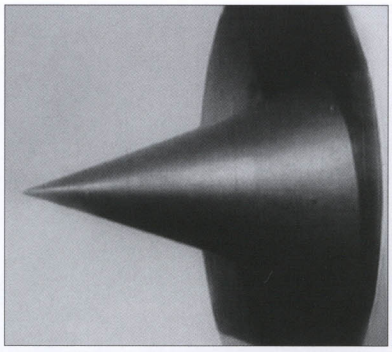
up pitot head is mounted on the upper starboard side of the nose.

On single-seat versions the pressurised cockpit is contained by pressure bulkheads at mainframes 6 and 11. It features an ejection seat (with guide rails attached to the rear pressure bulkhead), an instrument panel and side control consoles. On the MiG-21F/MiG-21F-13 and its licence-built versions – the Avia S-106, Shenyang J-7 and Chengdu J-7 I (F-7A) – the cockpit it is enclosed by a one-piece bubble canopy hinged at the front. It is actuated by two hydraulic rams, opening through 50°; the glazing comprises a blown main transparency made of ST-1 bullet-proof Perspex 10 mm (0$^{25}/_{64}$ in) thick and a quasi-oval optically flat triplex glass windscreen 14 mm (0$^{35}/_{64}$ in) thick set in a steel frame. The canopy is locked by side latches at the rear and interlocked with the ejection seat (see Crew escape system). Except on Czechoslovak-built examples (S-106s), the canopy's rear fairing blending into a shallow fuselage spine incorporates an additional blown transparency providing a measure of rearward view. All transparencies are sealed by rubber bands and sealing putty.

Protection for the pilot is afforded by a fixed bullet-proof triplex glass screen 62 mm (2$^{7}/_{16}$ in) thick located inside the canopy, as well as by metal armour at frames 6 and 11 and on the seat headrest.

The MiG-21PF/MiG-21PFS, MiG-21FL and early MiG-21PFMs (up to and including Batch 14) have basically the same canopy design, except that the fuselage spine is reshaped and hence there is no rear transparency. The MiG-21PFM, however, introduced a new canopy design from Batch 15 onwards together with a new ejection seat, featuring a fixed windshield and a section opening manually to starboard; the stamped duralumin windshield frame is hermetically riveted to the forward fuselage structure. The hinged portion with four locking lugs is secured in the open position by a fold-away strut. The windshield features two curved triangular Perspex sidelights 10 mm thick and a quasi-oval optically flat triplex glass windscreen 14 mm thick, whereas the hinged portion has a heat-resistant glass transparency 10 mm thick. On single-seat versions from the MiG-21SM (MiG-21MF) onwards the canopy incorporates a TS-27AMSh periscope for rearward vision; the MiG-21S and MiG-21R were retrofitted with the periscope as a mid-life update.

The forward avionics/equipment bay (frames 3-6) is located ahead of the cockpit, with the nosewheel well situated underneath. The bay has a removable dorsal access cover secured by



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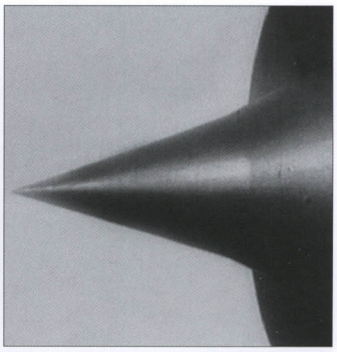

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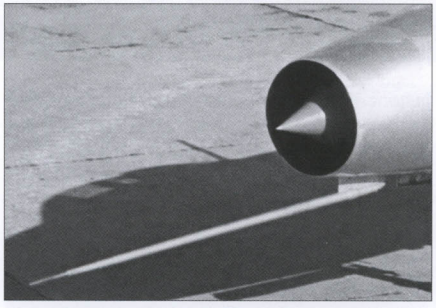
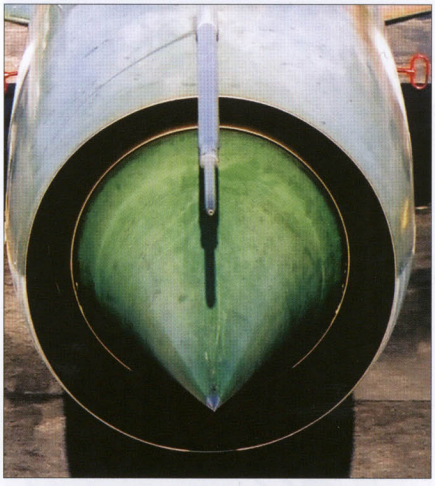
▲ **The air intake centrebody of the MIG-21F in fully aft (left) and fully forward positions.**



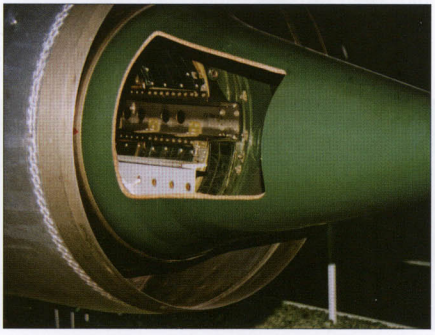
RSK MiG

◄ **The air intake and pitot boom of the MIG-21F.**



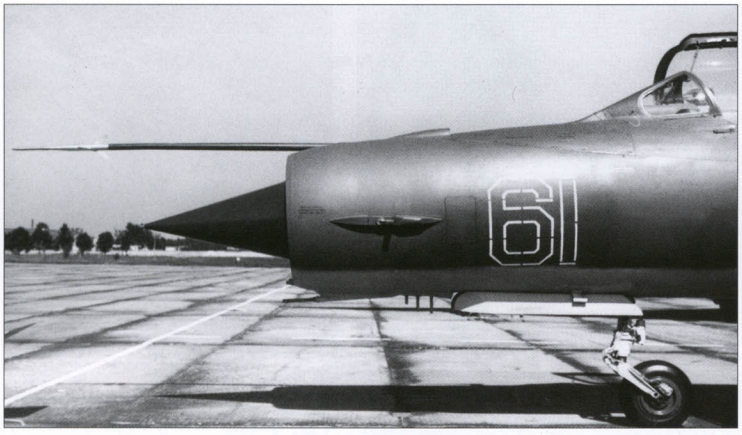
Simon Watson

◄ **The large air intake and radome of a MiG-21FL.**



Marcus Fulber

◄ **The cutaway radome of a MiG-21PFM used as a teaching aid, showing the radar set mounting rails. Note the complex shape of the radome at the base.**



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▲ **The nose of a MiG-21*bis*; note the cooling air outlets.**

This MiG-21F has a modified canopy with lock fairings but no rear transparency. ▼

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►▲ **The canopy of an early MiG-21F with lock fairings on top.**

► **The open canopy of a MiG-21F-13 with and without the SK ejection seat. Note the actuating rams.**

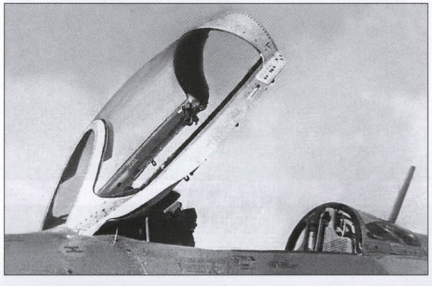
The canopies of Soviet-built (left) and Czech-built MiG-21F-13s. ▼

fasteners. On radar-equipped versions the cover features a cooling air outlet; a second air outlet is located ventrally ahead of the nosewheel well. A second avionics bay is located under the cockpit and accessed via a forward-hinged ventral door.

On single-seaters the centre fuselage portion houses six bladder tanks (fuel cells) arranged around the engine inlet duct between frames 11 and 28. Maintenance access to the tanks is provided by removable covers held in place by screws. A shallow spine housing control runs passes along the top of the fuselage from the canopy to the vertical tail. From the MiG-21PF onwards the spine also houses the strap-on No. 7 rigid fuel tank and equipment; hence it is recontoured, the shape varying from version to version. The spine tapers off towards the middle on the MiG-21PF/PFS/PFM/FL, tapering gently towards the fin on the MiG-21R/S/SM/M/MF, having a convex contour on the MiG-21MT/SMT, and reverting to an even upper contour but having a different juncture with the fuselage on the MiG-21*bis* and MiG-21ST.

The MiG-21F (and J-7) has two cannon bays (port and starboard) enclosed by teardrop-shaped fairings on the lower forward fuselage sides aft of the No. 2 avionics bay, with steel blast shields ahead of the muzzle openings; the starboard cannon bay is empty and the muzzle faired over on the MiG-21F-13 (S-106, J-7 I). The lateral cannon bays and associated fairings are eliminated on the MiG-21PF/PFS/PFM/FL, MiG-21S, MiG-21R and the trainer versions, but a centreline cannon bay located between frames 11-13 is introduced from the MiG-21SM onwards. The rear part of cannon fairing and part of the skin between frames 9- 11 are covered by 0.8-mm (0.0315-in) heat-resistant steel sheets.

RSK MiG



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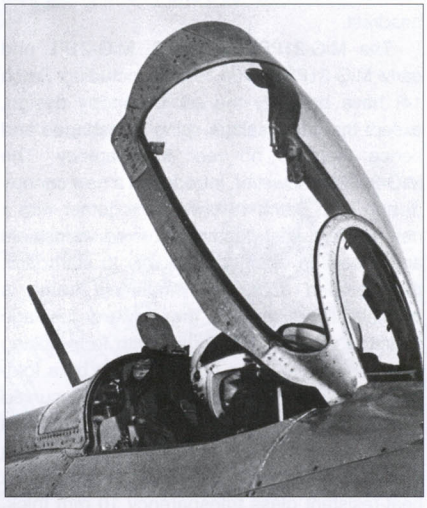

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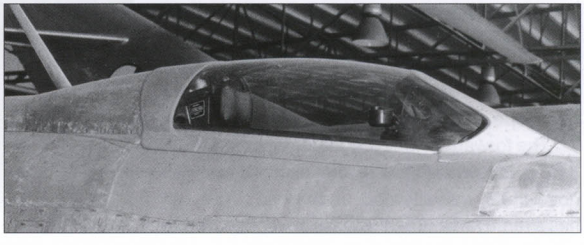

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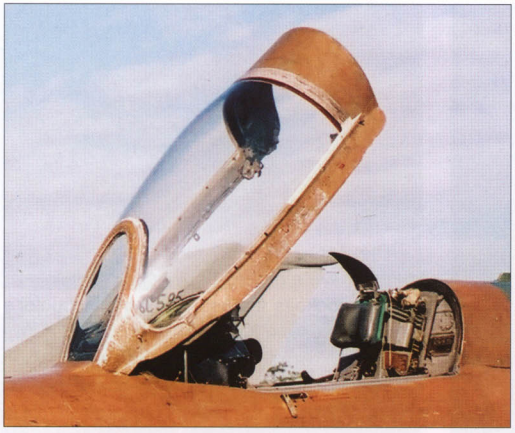

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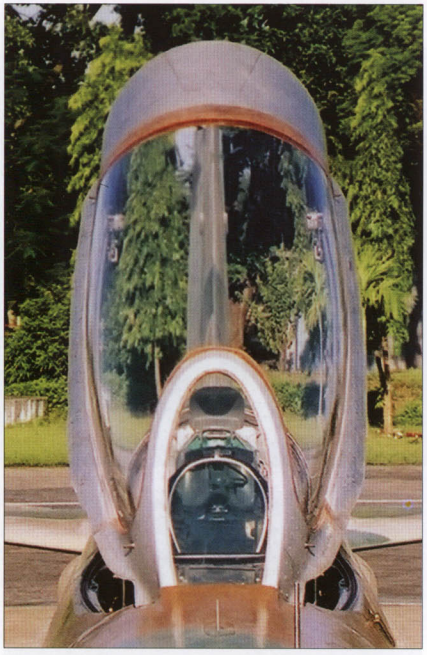

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The mainwheel wells are located between frames 16-20, flanking the inlet ducts; because the fuselage is area-ruled, the fuselage sides feature bulges accommodating the mainwheels. A detachable centreline pylon used for carrying a drop tank is fitted between frames 16-22.

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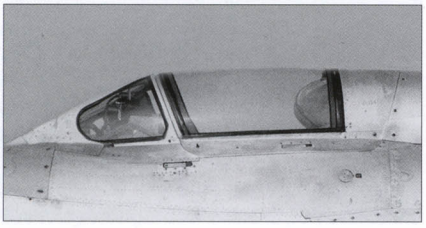


Two lateral airbrakes with a total area of 0.76 m² (8.18 sq ft) are mounted low on the forward fuselage sides at frames 11-13; maximum deflection is 25°. The forward airbrakes are bulged to match the shape of the cannon fairings. A third, ventral airbrake with an area of 0.47 m² (5.06 sq. ft) and a deflection of 40° is located at frame 22-25; it is perforated for maximum efficiency. The airbrakes are hydraulically operated. From the MiG-21PF onwards the forward airbrakes are no longer bulged (since the cannon fairings are gone); their total area and deflection angle are increased to 0.884 m² (9.5 sq ft) and 35° respectively. The two-seaters have a one-piece forward airbrake.

▲▲▲
The canopy of a MiG-21PFM featuring a rear view periscope.

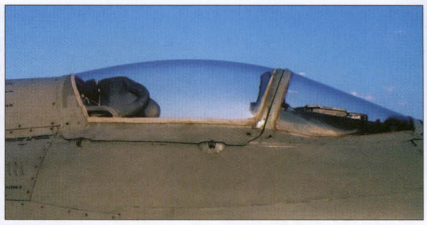
▲▲
The cockpits of a MiG-21UM.

▲
The open canopies of a MiG-21UM. Note the trainee's blind flying hood and the instructor's front view periscope.

▲◄
The canopy of a MiG-21FL.

◄
The canopy of a MiG-21S.

Simon Watson

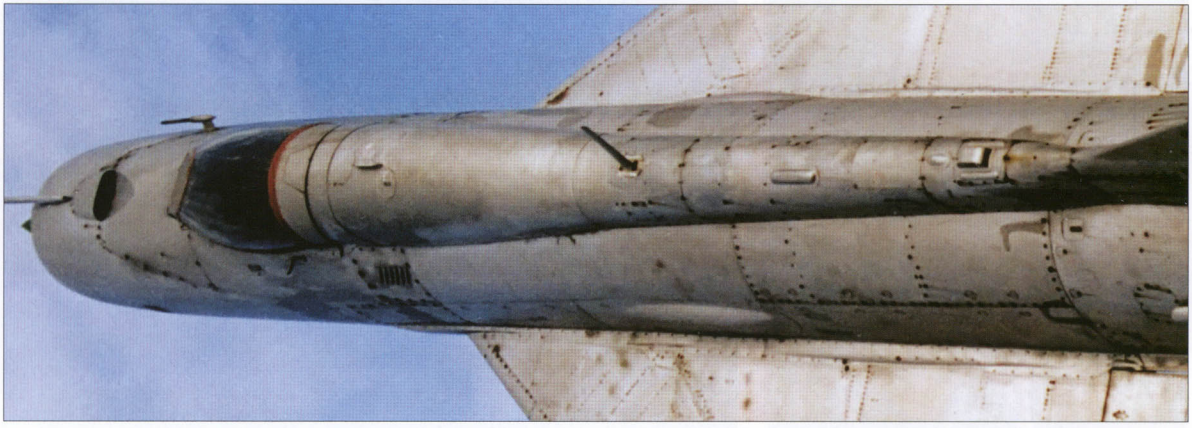


Simon Watson

▲►
The one-piece curved windshield and bulged canopy of the Indian MiG-21*bis* UPG.

The centre fuselage and fuselage spine of a MiG-21PF.
▼

The MiG-21U, MiG-21US and MiG-21UM trainers have a redesigned cockpit section with tandem cockpits (frames 6-14); the instructor's cockpit features a full set of controls and instruments. The cockpits are enclosed by a common canopy with a fixed windshield and individual sections opening manually to starboard; there is a glazed partition between the cockpits. On the MiG-21US and MiG-21UM the rear canopy



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►
The forward airbrakes of a MiG-21SM (right) and a MiG-21PFM (below right). The rear airbrake with the actuating ram disconnected for maintenance. Note also the open maintenance access panels; the rear fuselage is detached.
▼

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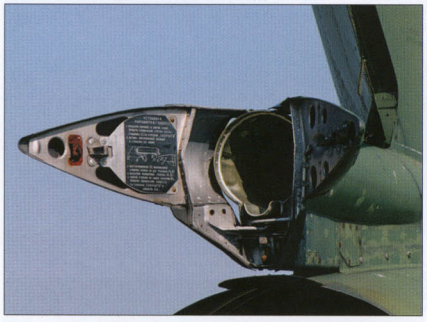
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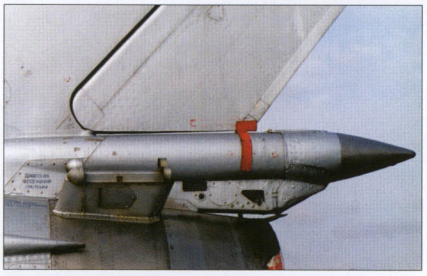
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section features a metal insert at the top incorporating a retractable periscope to provide the instructor with a measure of forward view on take-off and landing.

The number of bladder tanks in the trainers' centre fuselage is reduced to five; they are located between frames 14-28. A strap-on rigid fuel tank is housed in the fuselage spine between frames 14-22.

The *rear fuselage* (frames 28A-40) houses the engine with its accessories and carries the tail surfaces, including a ventral fin. It is attached to frame 28 by 18 bolts around the perimeter. The rear fuselage structure consists of 13 frames and a number of stringers supporting the skin. The rear fuselage inner skin is made of corrugated steel sheet. Firewalls made of high-carbon stainless steel are located in the engine bay at frames 29, 34, 35A and 36.

The MiG-21F/MiG-21F-13, MiG-21PF and MiG-21U have a ventral brake parachute bay closed by a single door offset to port beside the ventral fin. On subsequent versions from the MiG-21PFS onwards the bay is eliminated and the brake parachute is relocated to a cylindrical fairing with vertically split clamshell doors at the base of the vertical tail (see Landing gear).

Simon Watson

Wings: Cantilever mid-wing monoplane with pure delta (MiG-21 *sans suffixe*) or cropped-delta wings. Leading-edge sweep 57° from roots, anhedral 2°, incidence 0°, aspect ratio 2.22 (some sources say 2.5), taper 12.9. The wings utilise TsAGI S-11 high-speed airfoils; root chord 5.97 m (19 ft 7¾ in), tip chord 0.462 m (1 ft 6⅜ in) on all versions except the MiG-21 *sans suffixe*, mean aerodynamic chord (MAC) 4.002 m (13 ft 1⅜ in), thickness/chord ratio 4.5% at the root and 5% airfoil at the tip. Wingspan is 7.754 m (25 ft 5⅝ in) on the MiG-21 *sans suffixe* and 7.154 m

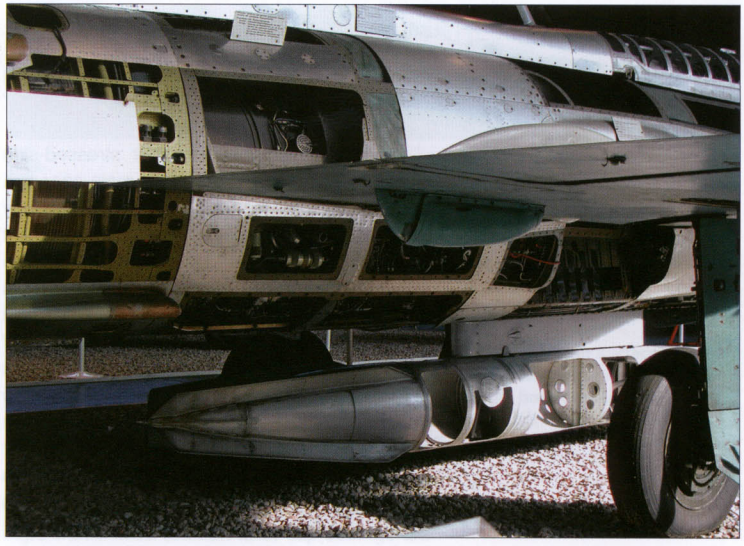
▲
The centre fuselage of a MiG-21*bis* UPG with conformal chaff/flare dispenser fairings.

▲▲◄
The rear fuselage of a MiG-21UM with engine cooling air scoops and tailplane actuator fairings.

▲◄
The open brake parachute doors.

◄
The brake parachute housing and tracer holders of an M-21 target drone.

The centre and rear fuselage of a cutaway MiG-21PF.
▼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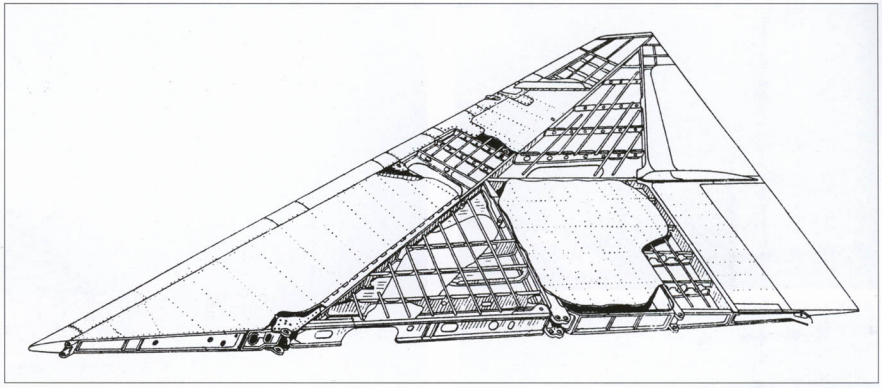

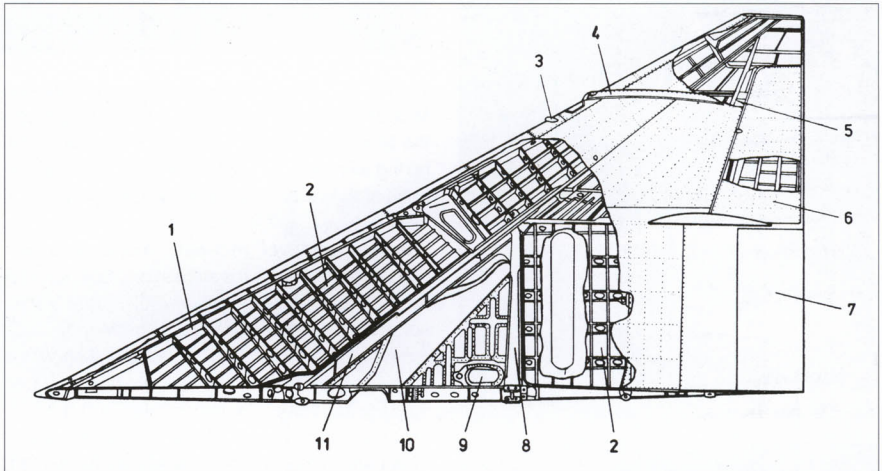

The wing panel structure of the MiG-21. 1. Front false spar; 2. Integral fuel tanks; 3. Navigation light; 4. Boundary layer fence; 5. Rear false spar; 6. Aileron; 7. Flap; 8. Main spar; 9. Recess for landing light; 10. Recess for main gear oleo strut; 11. Front spar.

(23 ft 5 21/32 in) on all subsequent versions; wing area 23.13 m² (248.7 sq ft) and 23.0 m² (247.57 sq ft) respectively.

The wings are of three-spar stressed-skin construction, with forward spar, main spar and rear spar plus forward and rear false spars; they are one-piece structures joined to the fuselage at the forged and machined root rib. The front false spar and the channel-section front spar both run across the entire span. They are built in two and three sections respectively; the root section of the front spar is made of duralumin and the rest is steel. The main spar is at right angles to the fuselage axis, terminating at rib 6; it is an I-beam made of steel. The channel-section rear spar also ends at rib 6; the channel-section rear false spar runs across the entire span and is built in two sections.

Each wing has 25 ribs ahead of the main spar (not counting the root rib), and 12 (11?) ribs aft of the main spar. The forward ribs are at 90° to the leading edge and front false spar; they are one-piece parts made of pressed duralumin sheet, with relief holes in the front portion. The rear ribs are parallel to longitudinal axis (at 90° to the trailing edge and rear false spar); they are assembled from two parts riveted together.

The skin is made of V95 aluminium alloy; the thickness varies from 2.5 mm (0.098 in) at the root to 1.5 mm (0.059 in) at the tip. In the area of the integral fuel tanks the skin thickness reaches 5 mm (0 13/64 in).

A recess for the main gear strut is located between the front and main spars of each wing; the main gear fulcrums are located at the joint of these spars near rib 5. On the MiG-21F and

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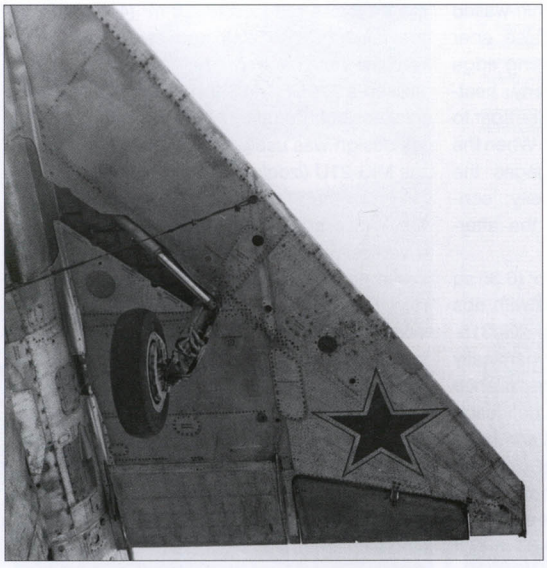

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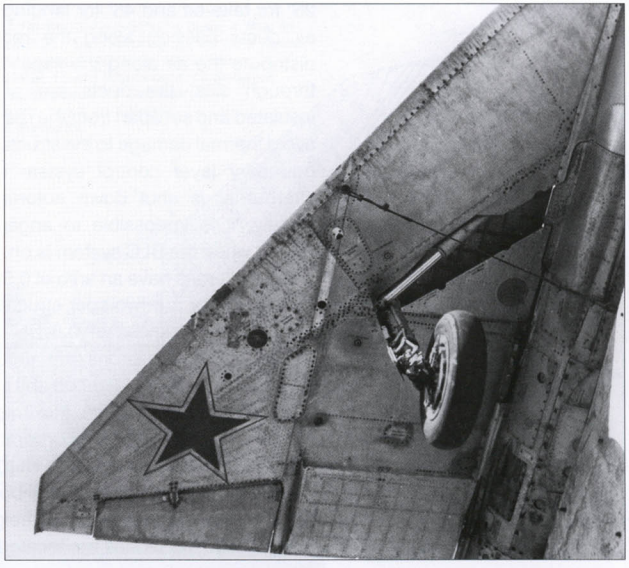

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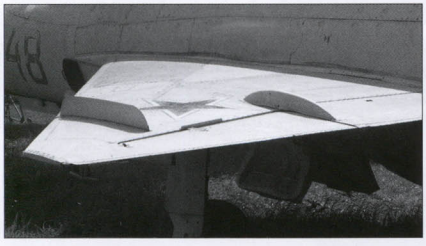

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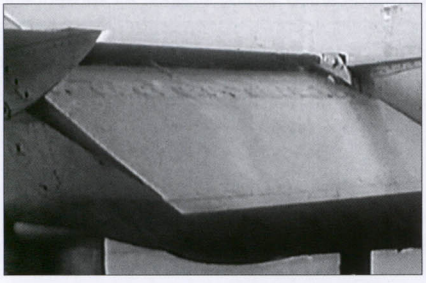

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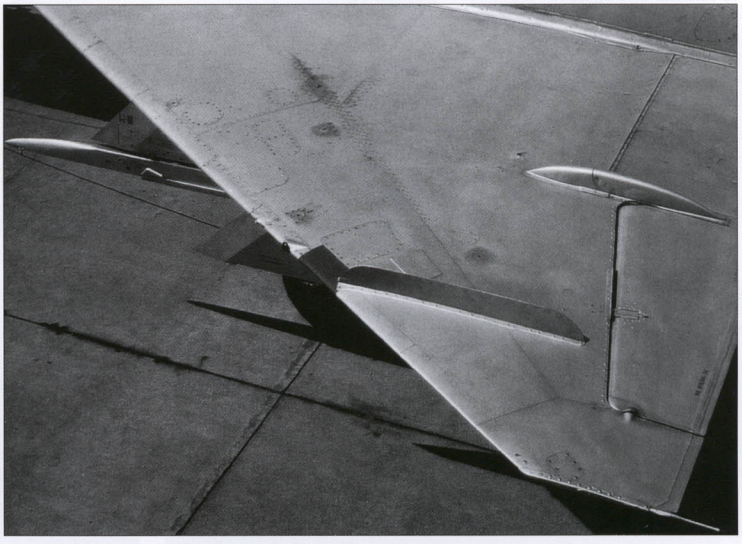

MiG-21F-13s up to and including c/n N74210814 the wing structure includes two integral fuel tanks located between the front spar and the front false spar up to rib 13. From MiG-21F-13 c/n N74210815 onwards (and on subsequent versions) a second pair of integral tanks was added between the main spar and the rear spar up to rib 6. All parts of the wing structure which come into contact with the fuel are protected against corrosion by chemical antioxidants.

The wing leading edge is fixed (there are no leading-edge devices). The trailing edge features hydraulically actuated rectangular one-piece flaps located between rear ribs 1 and 6, with tapered one-piece ailerons outboard of them (ribs 6-11); the ailerons stop short of the wingtips. The flaps are single-spar structures with a honeycomb trailing-edge section. The flaps each have a span of 1.239 m (4 ft 0$^{25}/_{32}$ in) and an area of 0.935 m^2 (10.05 sq ft), making up 8.14% of the wing area.

The early fighter versions and the MiG-21U trainer had area-increasing TsAGI flaps (modified Fowler flaps); flap settings were 24°30' for take-off and 44°30' for landing. Single-seat versions from the MiG-21PFS onwards, as well as the MiG-21US/MiG-21UM, feature blown flaps with a fixed rotation axis; flap settings are

▲▲
The wing undersurface of a MiG-21PF with the pylons removed. The landing lights are missing and their apertures are blanked off.

◄▲▲
The wing upper surface with the flap actuator fairing and the single boundary layer fence. Note that the navigation lights are located well inboard.

◄
The port flap set 25°.

25° for take-off and 45° for landing. Thin-walled air ducts passing along the rear false spar distribute the air along the flaps' leading edge through slits; the ducts are properly heat-insulated and set apart from the rear false spar to avoid thermal damage to the structure. When the boundary layer control system engages the afterburner is shut down automatically; conversely, it is impossible to engage the afterburner when the BLC system is on.

The ailerons have an area of 0.59 m² (6.35 sq ft) each. They are two-spar structures with ribs and a skin thickness of 0.8-1.5 mm (0.0315-0.0591 in). The ailerons are aerodynamically balanced and mass-balanced; the mass balance is inside the leading edge. Maximum deflection is ±20°. The port aileron incorporates a trim tab 0.4 m (1 ft 3¾ in) long and 0.01 m (0²⁵⁄₆₄ in) wide.

Each wing has a single small boundary layer fence on the upper surface, the height equalling 7% of MAC. The fences are located 0.67 m (2 ft 2⅜ in) from the tips, a short way inboard of the ailerons' outer ends.

On early single-seaters and the trainers the wings had two external stores hardpoints (ribs 13/front and 5/rear each incorporated an integral boss to support a single pylon). On single-seat versions from the MiG-21S onwards the number of wing hardpoints is increased to four (the attachment points for the outer pylons are located at ribs 18/front and 8A/rear).

Each wing is bolted to the fuselage by five fittings located at the front, main and rear spars. The fittings are located at frame 13 (with an 8-mm (0.315-in) vertical pin), frame 16 (with two 22-mm (0.866-in) vertical pins and one 16-mm (0.63-in) horizontal pin), frame 22 (with two 30-mm (1.18-in) vertical pins), frame 25 (with a 18-mm (0.708-in) vertical pin) and frame 28 (with a 12 mm (0.47-in) pin). The wing/fuselage joint is covered by a fillet attached by screws.

Tail unit: Conventional cantilever swept tail surfaces of stressed-skin construction; the skin thickness varies from 0.8 to 1.2 mm (from 0.0315 to 0.0472 in).

The *vertical tail* consists of a fin (which is attached to the fuselage by three fittings), a one-piece rudder and a ventral fin. The fin is a three-spar structure with ribs running at right angles to the main spar. Initially the fin had a sweepback of 60° at quarter-chord and a small root fillet. On the MiG-21F and the first 134 (some sources say 114) MiG-21F-13s the vertical tail area was 4.08 m² (43.92 sq ft). From the 135th (or 115th?) MiG-21F-13 onwards the vertical tail was reshaped, being somewhat shorter and broader; the area was reduced to 3.8 m² (40.9 sq ft) but the leading-edge kink and sweepback angle remained unchanged. The fin/rudder assembly utilised a TsAGI S-11S symmetrical airfoil with a thickness/chord ratio of 6.0%. The same vertical tail design was used on the MiG-21PF/PFS and the MiG-21U (*izdeliye* 66-400) trainer.

From the MiG-21PFS onwards the base of the fin incorporated a circular-section fairing with a vertically split parabolic rear end housing the brake parachute. The MiG-21PFM introduced a new fin of greater area with an unbroken leading edge. The sweepback at quarter-chord was increased to 61°27' and overall vertical tail area to 5.2 m² (55.97 sq ft), with an aspect ratio of 0.6 and a taper of 2.4; the fin thickness/chord ratio was reduced to 4.4%. The new vertical tail found use on all subsequent versions.

The MiG-21PFM, MiG-21FL and MiG-21U (*izdeliye* 66-600) have an all-metal fin. Later single-seat and two-seat versions feature a large GRP insert at the top enclosing communications and navigation system antennas.

The rudder is identical on all versions, having an area of 0.965 m² (55.97 sq ft) and a maximum deflection of ±25°. It is aerodynamically balanced and mass-balanced. The rudder has a main spar, two auxiliary spars and a skin thickness ranging from 1.2 mm (0.0472 in) at the leading edge to 0.8 mm (0.0315 in).

The initial MiG-21 *sans suffixe* has twin outward-canted ventral strakes. All subsequent versions feature a long ventral fin on the centreline starting at frame 28A, with a parabolic front end and a tapered rear end; the forward portion is made of GRP, enclosing a data link antenna. The ventral fin is 0.352 m (1 ft 1⁵⁵⁄₆₄ in) tall and 3.5 m (11 ft 5⁵¹⁄₆₄ in) long.

The *horizontal tail* comprises all-movable slab stabilisers (stabilators). On the MiG-21 *sans suffixe* the horizontal tail is shoulder-mounted; on all subsequent versions it is mid-set. The latter kind utilises an A6A NACA-M symmetrical airfoil with a thickness/chord ratio of 6.0%. Sweepback at quarter-chord 55°, no dihedral, aspect ratio 1.72, taper 2.38; span 3.74 m (12 ft 3¼ in). The stabilators rotate on axles set at 56° to the fuselage axis and located at 37.2% MAC; travel limits are 7°30' up and 16°30' down in the direction of flight, or 13° up and 28° down if measured at 90° to the rotation axis. The stabilators have faired anti-flutter weights at the tips projecting beyond the leading edge.

Landing gear: Hydraulically retractable tricycle type, with single wheel on each unit. Nose unit retracts forward, main units inward into wings

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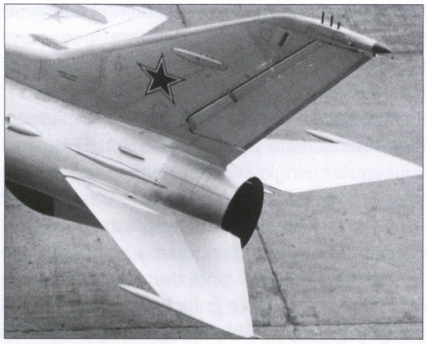

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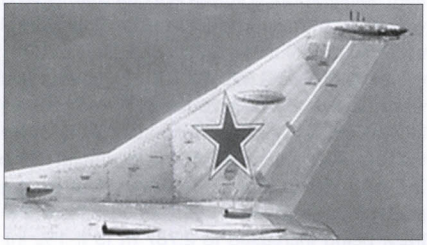

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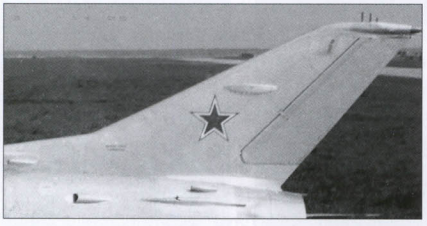
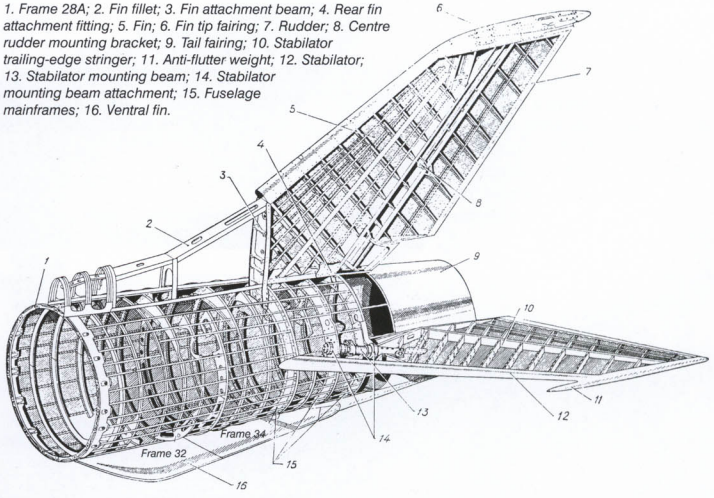


1. Frame 28A; 2. Fin fillet; 3. Fin attachment beam; 4. Rear fin attachment fitting; 5. Fin; 6. Fin tip fairing; 7. Rudder; 8. Centre rudder mounting bracket; 9. Tail fairing; 10. Stabilator trailing-edge stringer; 11. Anti-flutter weight; 12. Stabilator; 13. Stabilator mounting beam; 14. Stabilator mounting beam attachment; 15. Fuselage mainframes; 16. Ventral fin.



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▲
The rear fuselage and tail unit of the MiG-21U (*izdeliye* 66-600).

◄◄
The tail unit of a MiG-21F or an early MiG-21F-13 with the original narrow-chord fin.

◄
The tail of a later MiG-21F-13 with the wide-chord fin.

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▲
The tail unit of a MiG-21PF. Note the metal tip fairing (with SHORAN and DME antennas below it) and the varying shades of skin.

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►▲
The tail unit of a MiG-21*bis* with the Polyot-OI ILS (*Fishbed-N*).

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►
The tail unit of a MiG-21S; note the different spine/fin junction. The aircraft is crudely painted silver and the red star is lop-sided.

Simon Watson

▶
The vertical tail of a MiG-21*bis* UPG. Note the RHAWS antennas on the rear fin tip fairing and the fairing extending beyond the leading edge to give 360° coverage.
▼

Simon Watson

The port stabilator of a MiG-21PF; the panel line coincides with the rear spar.
▶▼

Opposite page:

▲▲
The landing gear of an early-production MiG-21F-13 with a KT-38 nosewheel and KT-82 mainwheels. Note the landing light mounted on the nose gear strut.

▶▲
The nose gear of a MiG-21UM with a KT-102 wheel.

▶▶▲
The nose gear of a late-production MiG-21F-13.

▶▶▶▲
The main gear units of a MiG-21PFM with KT-92 wheels.

▶
The main gear doors and the starboard mainwheel well of a MiG-21PFM.

and fuselage; in the process the mainwheels rotate 87° around the oleos by means of mechanical links to lie almost vertically beside the inlet duct.

On the MiG-21F/MiG-21F-13, MiG-21PF/PFS and early-production MiG-21PFMs, as well as MiG-21U trainers up to and including Tbilisi-built Batch 6, the levered-suspension nose unit attached to fuselage frame 6 has a 500 x 180 mm (19.68 x 7.08 in) KT-38 nosewheel set in a fork and equipped with twin pneumatic expander-tube brakes. Late-production MiG-21PFMs and subsequent single-seaters, as well as trainers from MiG-21U c/n 01665107 onwards, have a KT-102 nosewheel of identical size equipped with an eight-piston disc brake.

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On the MiG-21F and the first production MiG-21F-13s the main units had 600 x 200 mm (23.62 x 7.87 in) KT-82 wheels; later MiG-21F-13s and early-production MiG-21PFs had main-wheels of the same model but equipped with wider 600 x 220 mm (23.62 x 8.66 in) tyres. The wheel track was 2.692 m (8 ft 9$^{63}/_{64}$ in) and the wheelbase 4.78 m (15 ft 8$^{3}/_{16}$ in). Late-production MiG-21PFs and subsequent versions, including the two-seaters, had new 800 x 200 mm (31.49 x 7.87 in) KT-92 mainwheels with 12-piston pneumatic disc brakes; this resulted in the wheel track being increased to 2.787 m (9 ft 1$^{23}/_{32}$ in) and the wheelbase being shortened to 4.71 m (15 ft 5$^{7}/_{16}$ in). The latest versions of the MiG-21 could be fitted with KT-90D mainwheels featuring cerametallic disc brakes.

Tyre pressure is 7+0.5 kg/cm^2 (100+7.14 psi) for the nosewheel and 8+0.5 kg/cm^2 (114.28+7.14 psi) for the mainwheels. Brake system pressure is 19.4 kg/cm^2 (277 psi).

All three units have oleo-pneumatic shock absorbers. The oleo stroke is 86+2 mm (3.38+0.078 in) for the nose unit and 230+2 mm (9.05+0.078 in) for the main units. Shock absorber oil capacity is 650 cm^3 (39.65 cu in) for the nose unit and 2,200 cm^3 (134.2 cu in) for the main units; nitrogen pressure in the oleos is 3.7+0.1 MPa for the nose unit and 3+0.1 MPa for the main units. The latter have torque links; the upper portions of the main gear struts double as air bottles of the main pneumatic system (which see).

On the MiG-21F/MiG-21F-13, the nose unit is castoring; steering on the ground is by differential braking. Late versions have a hydraulically steerable nose gear unit; steering angles are ±47°.

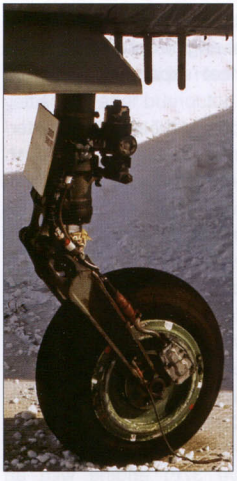
All three units have mechanical uplocks. In the extended position the landing gear is secured by mechanical downlocks and by shutoff valves trapping hydraulic fluid in the retraction jacks which double as sway braces on the main units. Normal operation is hydraulic, with pneumatic emergency extension. Additionally, in an emergency the nose gear uplock can be released by means of a cable

(operated from the front cockpit only on the two-seaters), providing for free-fall extension aided by the slipstream.

The nosewheel well is closed by twin lateral doors, the mainwheel wells by triple doors (two narrow segments are hinged to each oleo and the bulged main doors are hinged to the fuselage). All doors remain open when the gear is down. Landing gear position is indicated by warning lamps on the instrument panel and by mechanical indicators, as well as by external indicator lamps allowing ground personnel to check at night if the gear is down. A sprung tail bumper built into the ventral fin protects the rear fuselage in a tail-down landing.

The MiG-21F/MiG-21F-13, MiG-21PF/PFS and MiG-21U had a circular PT-5759-58 brake parachute (*para**shoot** tormoz**noy***) with an area of 16 m² (172.22 sq. ft) stowed in a bay with a single door on the port side of the ventral fin. The parachute shortened the landing run by some 400 m (1,310 ft). The MiG-21FL introduced a

RSK MiG



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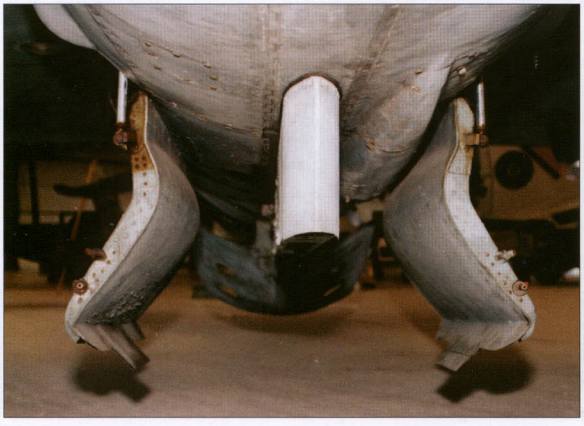

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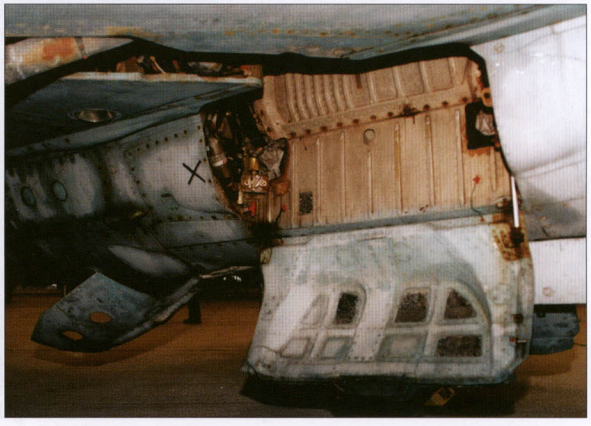

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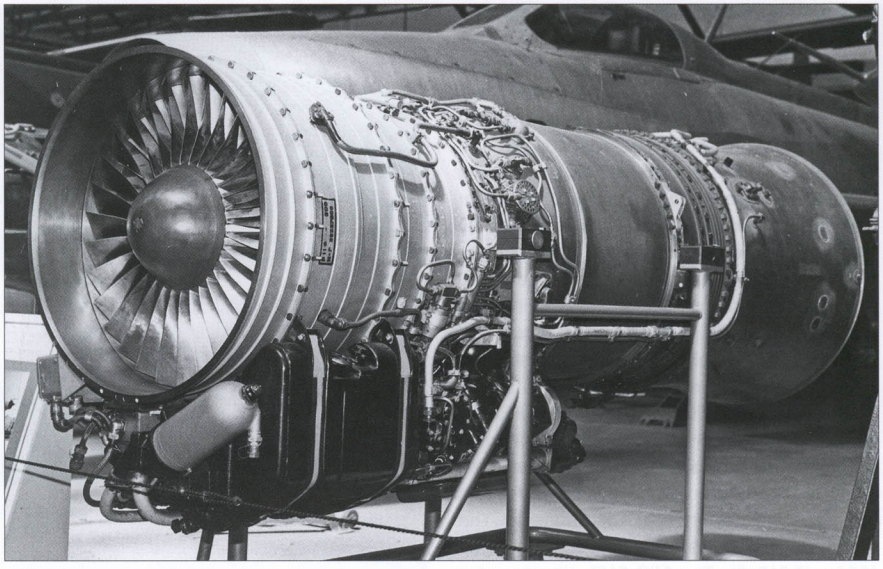


The Tumanskiy R11F-300 turbojet.

via RART

PT-5282-62 cruciform brake parachute with an area of 19 m^2 (204.51 sq. ft) brake parachute stowed in a cylindrical housing with clamshell doors at the base of the rudder. Late versions are equipped with a PT-21UK brake parachute.

Powerplant: The MiG-21F *sans suffixe* is powered by one Tumanskiy (AMNTK Soyuz) R11-300 (*izdeliye* 37) axial-flow afterburning turbojet rated at 3,880 kgp (8,550 lbst) dry and 5,110 kgp (11,265 lbst) reheat.

The engine is a two-spool turbojet with a fixed-area air intake, a three-stage supersonic low-pressure (LP) compressor, a three-stage transonic high-pressure (HP) compressor, a can-annular combustion chamber, single-stage HP and LP turbines, and an afterburner with a multi-petal axisymmetrical variable nozzle. No inlet guide vanes or variable stators. The first compressor stage is overhung ahead of the front bearing, facilitating repair, and has a parabolic spinner; the second compressor stage has shrouded blades to prevent resonance vibrations. The HP spool has a speed limiter. The accessory gearbox driven off the HP spool is located ventrally aft of the sixth compressor stage and has nine drive faces, seven of which are normally occupied by the starter/generator, two hydraulic pumps, two fuel pumps, the air compressor and the tachometer-generator. The combustion chamber has 12 flame tubes, two of which feature high-energy discharge igniters. The afterburner has three spray rings. The nozzle is controlled by an electrohydraulic system with three rams driving the actuation ring. When the engine is cold the axis of the afterburner/nozzle assembly is angled slightly to port with respect to the engine spools; this angle disappears due to heat expansion when the afterburner becomes hot.

Starting is electrical by means of a starter/generator and is controlled by a single push button. Initial light-up is done using petrol from an auxiliary tank.

Overall engine pressure ratio (EPR) 8.6; mass flow at take-off power 64.5 kg/sec (142.2 lb/sec). Turbine temperature 1,175° K. Specific fuel consumption (SFC) at take-off power (in full afterburner) 1.96 kg/kgp·hr (lb/lbst·hr); cruise SFC 0.94 kg/kgp·hr. Length overall 4.66 m (15 ft 3 15/32 in), maximum diameter 0.825 m (2 ft 8 31/64 in). Dry weight 1,040 kg (2,290 lb).

The MiG-21F/MiG-21F-13 and MiG-21U have an R11F-300 (*izdeliye* 37F) engine with an afterburner rating increased to 5,740 kgp (12,650 lbst). The R11F-300 has an all-supersonic compressor, a new welded combustion chamber, an HP turbine of 15 mm (0 15/32 in) greater diameter, an LP turbine with narrower blades, and a modified afterburner with a fully adjustable (all-mode) nozzle allowing the thrust in reheat mode to be adjusted smoothly. A PURT-1F precise electromechanical engine control system, together with the main and afterburner fuel pumps, ensures smooth operation of the engine throughout the speed range from ground idle to full afterburner rpm. A gaseous oxygen feed system is added to facilitate relight at extreme altitudes and low forward speeds.

The R11F-300 has a self-contained lubrication system using MK-8 mineral oil and later VNII NP-50-1-4F synthetic oil (VNII NP = *Vsesoyooznyy naoochno-issledovatel'skiy institoot nefteprodooktov* – All-Union Petroleum Products Research Institute). The system includes a fuel/oil heat exchanger. The oil tank is located below the front end of the engine casing.

EPR 8.9; mass flow at take-off power 63.7 kg/sec (140.4 lb/sec). Turbine temperature 1,170° K. SFC at take-off power (in full afterburner) 2.19 kg/kgp·hr; cruise SFC 0.94 kg/kgp·hr. Dry weight 1,182 kg (2,606 lb). The engine was produced by the Moscow Engine Manufacturing Enterprise (MMPO) named after V. V. Chernyshov.

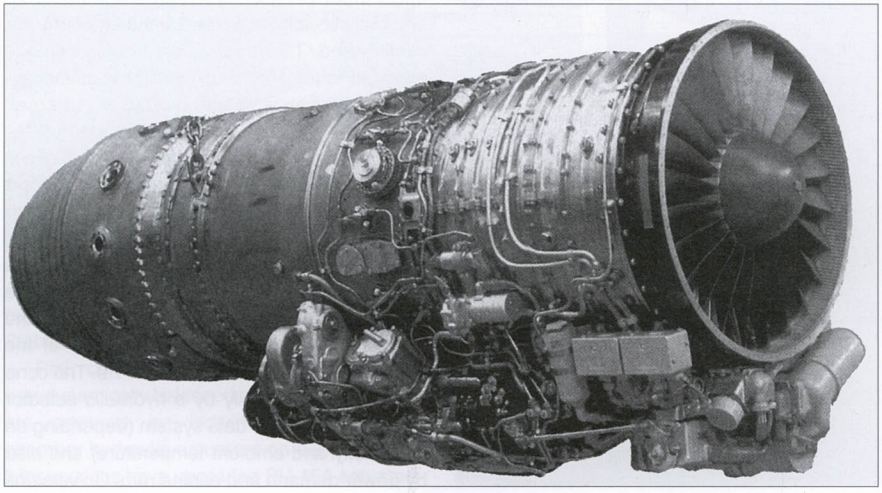
The MiG-21PF is powered by an R11F2-300 (*izdeliye* 37F2) engine with a modified afterburner delivering 3,950 kgp (8,710 lbst) at full military power, 5,900 kgp (13,010 lbst) in minimum afterburner and 6,120 kgp (13,490 lbst) in full afterburner. It also introduced the ability to use SPRD-99 solid-propellant JATO boosters with a thrust of 2,500 kgp (5,510 lbst) each; the two boosters were attached to special locks low on the rear fuselage sides and jettisoned after burnout.

The MiG-21PFS, MiG-21R, MiG-21S and MiG-21US/MiG-21UM all have the identically rated R11F2S-300 (*izdeliye* 37F2S) version, which has air bleed valves at the sixth compressor stage to cater for the flap blowing (BLC) system, hence the S for *sdoov pogranichnovo sloya*. The bleed rate does not exceed 2.5 kg/sec (.5.5 lb/sec) and the system operates with the engine running in dry thrust mode (the afterburner is shut down when the system is switched on). The MiG-21M export fighter is powered by the export version of the above engine designated R11F2SK-300 (*izdeliye* 37F2SK), the K standing for *kommehrcheskiy* ('commercial', that is, for export). These engines were produced by the Ufa aero engine plant No. 26 (UMPO) in 1962-1975.

The MiG-21SM/MiG-21MF and MiG-21SMT introduced a new engine – the Tumanskiy (GNPP Motor) R13-300 axial-flow afterburning turbojet rated at 4,100 kgp (9,040 lbst) at full military power and 6,600 kgp (14,550 lbst) in full afterburner. (Some sources quote a thrust of 4,070 kgp (8,970 lbst) and 6,490 kgp (14,310 lbst) respectively.) This is likewise a two-spool turbojet with a three-stage LP compressor, a five-stage HP compressor, an annular combustion chamber, single-stage HP and LP turbines and an afterburner of 0.906 m (2 ft 11$^{45}/_{64}$ in) diameter with an all-mode variable nozzle. The afterburner features annular/radial flame holders and a perforated heat shield. The nozzle diameter is 0.53 m (1 ft 8$^{55}/_{64}$ in) at full military power, 0.6 m (1 ft 11⅝ in) in minimum afterburner and 0.68 m (2 ft 2$^{49}/_{64}$ in) in full afterburner.

EPR 9.15 at full military power and 9.25 in full afterburner; mass flow at take-off rating 66 kg/sec (145.5 lb/sec), turbine temperature 1,193° K at full military power and 1,223° K at take-off power. SFC 2.25 kg/kgp·hr in full afterburner and 0.96 kg/kgp·hr in cruise mode. Length overall (including afterburner) 4.6 m (15 ft 1½ in), casing diameter 0.907 m (2 ft 11¾ in). Dry weight 1,134 kg (2,500 lb), though some sources quote 1,116.75 kg (2,461 lb). The engine was manufactured by the Ufa aero engine plant (UMPO) in 1968-1986.

Finally, the MiG-21*bis* is powered by the Tumanskiy (GNPP Motor) R25-300 (*izdeliye* 25)



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◀ **The Tumanskiy R13-300 turbojet.**

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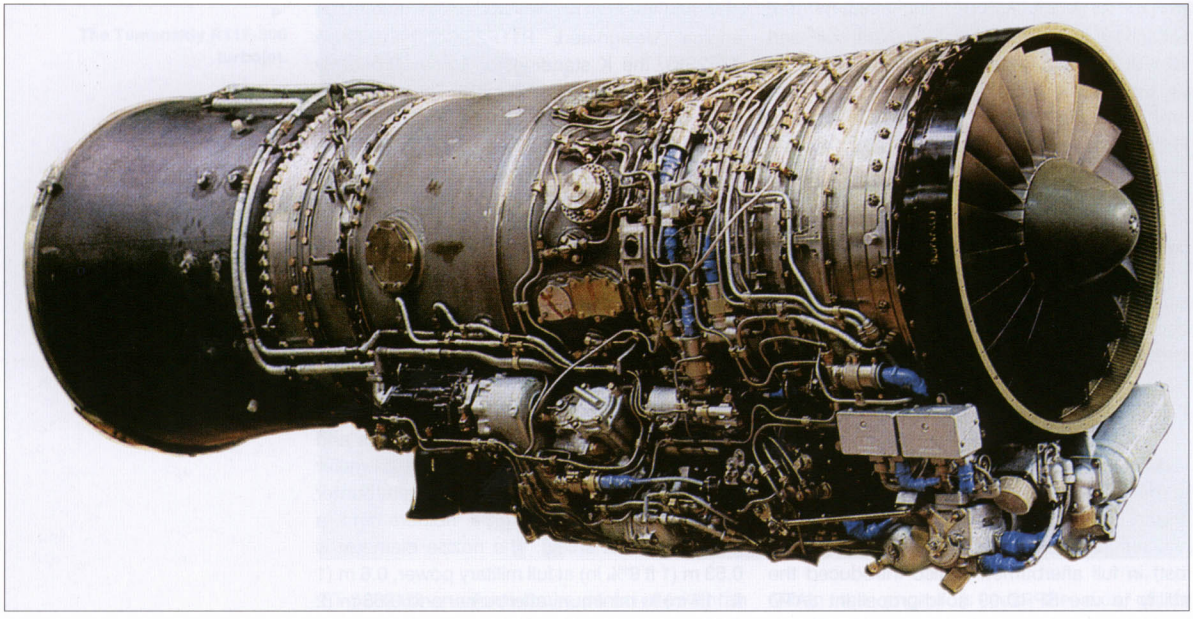
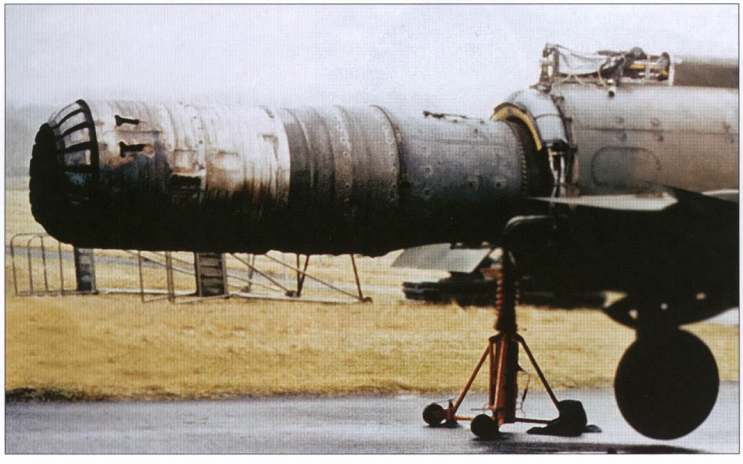


▲ **The Tumanskiy R25-300 turbojet.**

axial-flow afterburning turbojet – a derivative of the R13-300 delivering 4,100 kgp at full military power and 6,850 kgp (15,100 lbst) for take-off, with a contingency rating of 7,100 kgp (15,650 lbst). (Some sources quote 7,100 kgp as the maximum afterburner rating for normal operation and state the contingency rating as 9,500 kgp (20,940 lbst), the running time in this mode being limited to several seconds.) The R25-300 has a three-stage LP compressor with broad-chord titanium blades on the first stage, a five-stage HP compressor, an annular combustion chamber, single-stage HP and LP turbines and a modernised afterburner with two fuel pumps of equal output and improved cooling. The nozzle diameter at various power settings is as quoted for the R13-300.

EPR 9.55 at take-off power (6,850 kgp) and 9.8 in contingency mode; mass flow at take-off power 68.5 kg/sec (151 lb/sec), turbine temperature 1,310° K at take-off power and 1,360° K in contingency mode. SFC 2.25 kg/kgp·hr in full afterburner and 0.96 kg/kgp·hr in cruise mode. Length overall (including afterburner) 4.615 m (15 ft 1⁴⁵⁄₆₄ in), casing diameter 0.907 m (2 ft 11¾ in). Dry weight 1,215 kg (2,680 lb). The engine was likewise manufactured by the Ufa aero engine plant (UMPO) in 1972-1986.

This picture shows how the rear fuselage of the MiG-21 can be removed, exposing the engine for maintenance. ▼



Helmut Walther

In all cases the engine is mounted on an upper trunnion attached to fuselage frame 25 and two supports at frame 28; the afterburner is cantilevered. The greater part of the engine is exposed when the rear fuselage is detached. The engine bay is cooled by ram air, using air scoops on the centre and rear fuselage.

The engine breathes through an axisymmetrical variable supersonic air intake with a three-position, three-shock centrebody. The latter is in the full aft position at speeds up to Mach 1.5, assuming an intermediate position at Mach 1.5 and moving fully forward (to focus the shock waves on the inlet lip and reduce the annular area for airflow to below 93% of the maximum) at speeds above Mach 1.9. The cone is driven automatically by a hydraulic actuator controlled by the air data system (depending on air density and ambient temperature) and also by power demand and engine rpm. On versions

with the large shock cone (single-seaters from the MiG-21PF onwards), cone travel is 20 cm (7⅞ in). The inlet duct bifurcates at frame 3 but merges again at frame 22; a rubber ring at this location seals the gap between the duct and the engine compressor inlet. Two inward-opening auxiliary inlet doors located on the sides of the nose between frames 3-4 are controlled automatically by a hydraulic ram linked to the inlet control system, to improve the airflow in the duct in yawed flight and avoid violent compressor stalls. Additionally, two spring-loaded blow-in doors at frame 10 provide an adequate airflow under conditions of high power demand and low ram pressure (for example, on take-off) to prevent compressor stalls.

Control system: Conventional mechanical flight control system with push-pull rods, control cranks and levers.

Pitch (longitudinal) control is provided by slab stabilisers (stabilators), which are actuated by a single BU-51M twin-chamber hydraulic actuator on early versions; later versions have a BU-210B actuator. The tailplane control circuit features an ARU-3V automatic trim mechanism alleviating the stick forces (replaced by the ARU-3MV on the final versions); tailplane trim is controlled by a slide switch on the control stick. Stabilator travel is 7°30' up and 16°30' down.

Roll control is provided by one-piece aerodynamically balanced ailerons. The ailerons are powered by individual BU-45 single-chamber hydraulic actuators on early versions; later versions have upgraded BU-45A actuators. The actuators are located at ribs 6L and 6R. The port aileron has a trim tab. Aileron deflection is ±18° and trim tab deflection ±15°.

Directional control is provided by a one-piece aerodynamically balanced rudder. The rudder is controlled manually by means of pedals which are also linked to the nose gear steering mechanism. Rudder deflection is ±25°.

Early single-seaters (up to and including the MiG-21PFM/MiG-21FL) and the MiG-21U trainer were equipped with a KAP-2 or KAP-2K single-channel autopilot serving only the roll control channel (hence the KAP for ***kren****ovyy avtopi****lot*** – bank [control] autopilot) to enhance flight safety in IMC and at night. The KAP-2 limited the aircraft's bank angle to ±35°. It had two operating modes: roll damping and stabilisation. In the former mode it damped the aircraft's roll oscillations, monitoring the roll rate; in stabilisation mode it kept the wings level and brought the aircraft into wings-level flight from any attitude.

All single-seat versions from the MiG-21R onwards, as well as the MiG-21US/MiG-21UM trainers, have an AP-155 three-channel autopilot operating the controls through RAU-107 and RAU-107A servos. On late versions the grip of

A 490-litre PTB-490 drop tank with cruciform fins on the centreline pylon of a MiG-21. The rear airbrake cannot be deployed with the drop tank in place.
◄▼

A 800-litre PTB-800 drop tank on the centreline pylon of a MiG-21.
▼▼

PTB-490 drop tanks on the outer wing pylons of a MiG-21*bis* (left) and a MiG-21R.
◄▼▼

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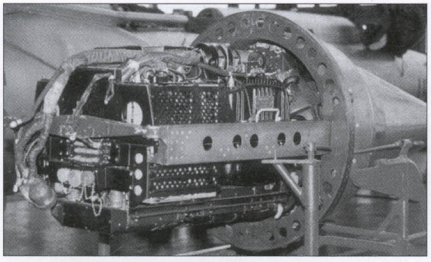
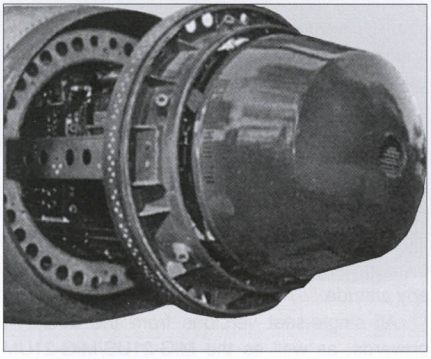


Jaroslaw Sobocinski

▶ An RP-21M radar (complete with radome and bearer) rests on a handling dolly, having been removed from a MiG-21PFM during an overhaul.



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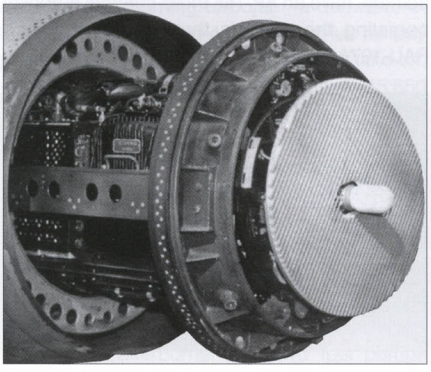
▶ The RP-21M radar slid forward on its bearer for maintenance. The radome is removed, showing the dielectric antenna shroud.



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▶ The same radar with the antenna shroud removed, exposing the antenna.

the control stick is mounted on a universal joint which allows it to be deflected slightly to activate microswitches, thereby overriding the autopilot.

Fuel system: On the MiG-21F and early-production MiG-21F-13s up to and including Batch 6, internal fuel was carried in six bladder tanks in the fuselage around the engine inlet duct and two integral tanks in the wings ahead of the front spar holding a total of 2,160 litres (475.2 Imp gal). The bladder tanks have an inner layer of fuel-resistant rubber 0.5 mm (0.0197 in) thick and an outer layer of rubberised fabric 1.1-29.5 mm (0.043-1.16 in) thick. They are housed in special metal containers integrated into the fuselage structure. The No. 3 tank is the service tank. A special valve in this tank ensures stable engine operation in inverted flight for up to 15 seconds at full military power or five seconds in afterburner mode.

On MiG-21F-13s from c/n N74210701 up to and including c/n N74210814 the internal fuel capacity was increased to 2,280 litres (501.6 Imp gal) while retaining the same number of tanks. From MiG-21F-13 c/n N74210815 onwards a second pair of integral wing tanks was added aft of the main spar, increasing total capacity to 2,470 litres (543.4 Imp gal); some sources state 2,480 litres (545.6 Imp gal). The wing tanks are all connected to the No. 2 fuselage tank. The fuel was distributed as follows: No. 1 fuselage tank, 235 litres (51.7 Imp. gal.); No. 2 tank, 720 litres (158.4 Imp gal); No. 3 tank, 265 litres (58.3 Imp gal); No. 4 tank, 200 litres (44 Imp gal); Nos. 5 and 6 tanks, 240 litres (52.8 Imp gal) each; forward wing tanks, 175 litres (38.5 Imp gal) each; rear wing tanks, 110 litres (24.2 Imp gal) each.

The MiG-21PF/MiG-21PFS, MiG-21PFM and MiG-21FL had a reshaped fuselage spine housing a rigid No. 7 strap-on fuel tank (saddle tank); the bladder tanks inside the fuselage were all new and the forward wing tanks were slightly enlarged. The distribution of internal fuel was as follows: No. 1 fuselage tank, 60 litres (13.2 Imp gal); No. 2 tank, 930 litres (204.6 Imp gal); No. 3 tank, 335 litres (73.7 Imp gal); No. 4 tank, 175 litres (38.5 Imp gal); No. 5 tank, 245 litres (53.9 Imp gal); No. 6 tank, 185 litres (40.7 Imp gal) each; No. 7 tank, 170 litres (37.4 Imp gal); forward wing tanks, 180 litres (39.6 Imp gal) each; rear wing tanks, 110 litres (24.2 Imp gal) each. This gave a total capacity of 2,680 litres (589.6 Imp gal).

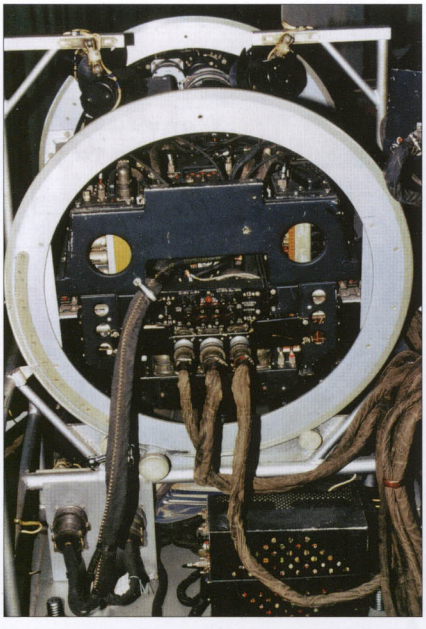
The MiG-21R, MiG-21S/MiG-21M and MiG-21SM/MiG-21MF had the No. 1 bladder tank deleted but the saddle tank was enlarged to hold 510 litres (112.2 Imp gal); the internal fuel capacity totalled 2,800 litres (616 Imp gal).

The MiG-21MT and MiG-21SMT had an even larger saddle tank. Formally this increased the total capacity to 3,250 litres (715 Imp gal); yet the maximum permitted fuel quantity was restricted to 2,950 litres (649 Imp gal).

The MiG-21bis features a new saddle tank which is smaller than the MiG-21SMT's but larger than the MiG-21SM's. The internal fuel capacity totalled 3,041 litres (669 Imp gal).

On the trainer versions, internal fuel is carried in five bladder tanks inside the fuselage, a saddle tank and four integral tanks in the wings. This gave a total capacity of 2,350 litres (517 Imp gal) for the MiG-21U and 2,450 litres (539 Imp gal) for the MiG-21US/MiG-21UM. The fuselage tanks are pressurised to 0.21-0.23 kg/cm^2 (3.0-3.28

Marcus Fulber



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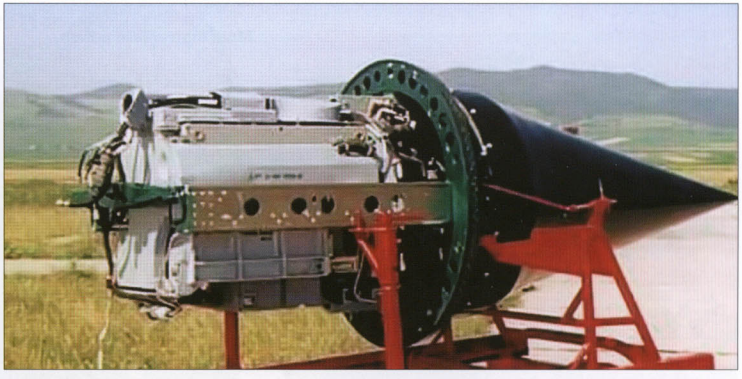

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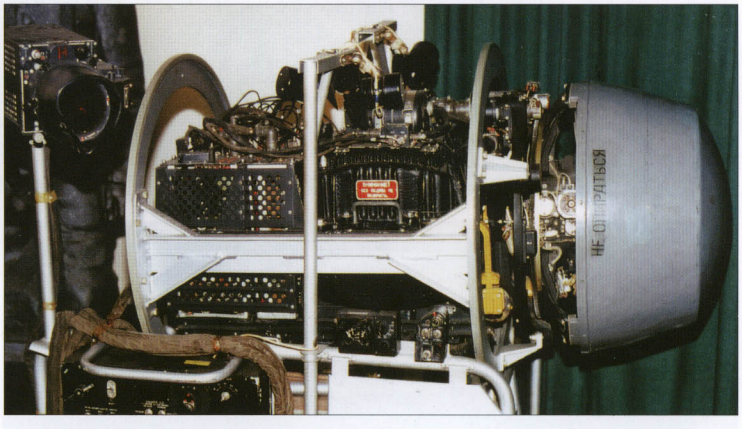


psi) and the wing tanks to 0.41-0.43 kg/cm² (5.85-6.14 psi).

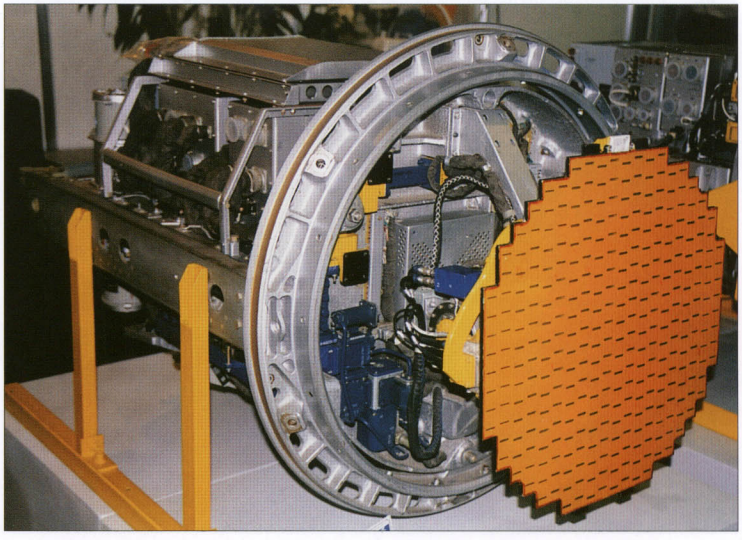
The fuel pumps are driven by fuel-cooled electric motors. Model 495B electric centrifugal pumps with a 14,000 litres (3,080 gal) per minute delivery rate are in the Nos. 3 and 4 tanks, and a Model 422 pump with a 8,000 litres (1,760 gal) per minute delivery rate is in the No. 2 tank.

All versions have a 'wet' centreline pylon permitting carriage of a 490-litre (107.8 Imp. gal.) PTB-490 drop tank; the tank is of circular cross-section with a pointed nose and cruciform fins. The tank weighs 70 kg (154 lb) empty and 470 kg (1,036 lb) full. Single-seat versions from the MiG-21R onwards have 'wet' outer wing pylons allowing additional PTB-490 drop tanks to be carried; they can also carry an 800-litre (176 Imp. gal.) oval-section PTB-800 centreline drop tank with no fins. The drop tanks are pressurised to 0.81-0.83 kg/cm² (11.57-11.85 psi). The fuel metering system indicates when internal fuel is down to 450 litres (99 Imp gal) and the fuel in the drop tank(s) down to 100 litres (22 Imp gal).

The MiG-21 uses Russian T-1, T-2 or TS-1 jet fuel or Western equivalents (JP-4, Czech PL-6 etc.). Refuelling is by gravity via a single filler cap in the No. 7 fuselage tank. A defuelling valve is located at frame 28. The drop tanks have individual filler caps.

Hydraulics: For the sake of reliability the MiG-21 has two separate hydraulic systems, each with its own NP-34M-1T engine-driven variable-

▲▲
A Chinese derivative of the RP-21 radar fitted to the Chengdu J-7D.
◄▲
An RP-22 radar on display with the radome removed.
The Phazotron Kop'yo radar.
▼



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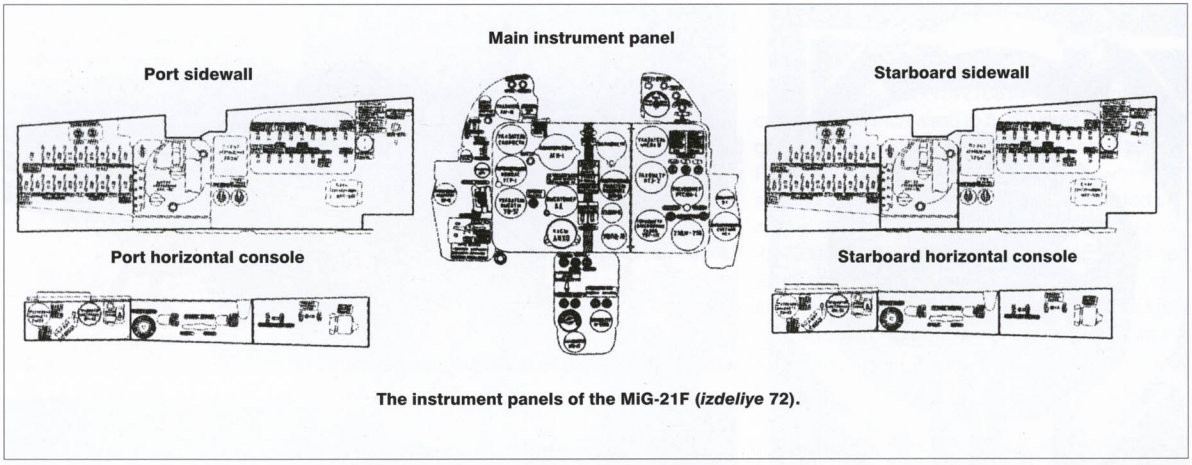
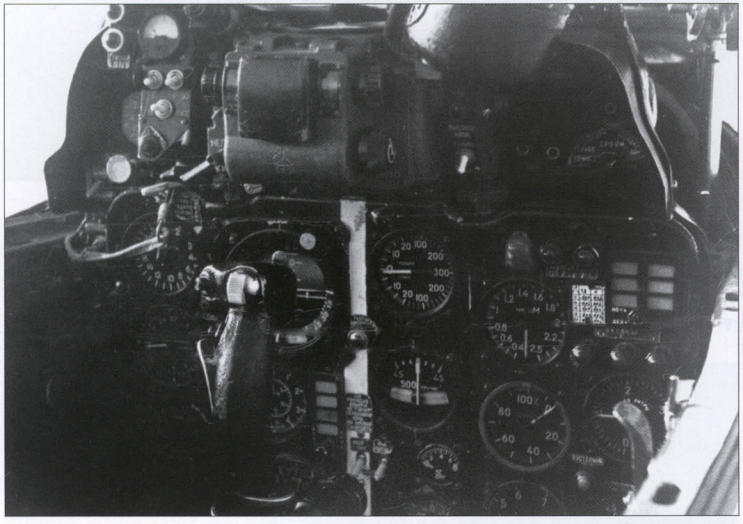


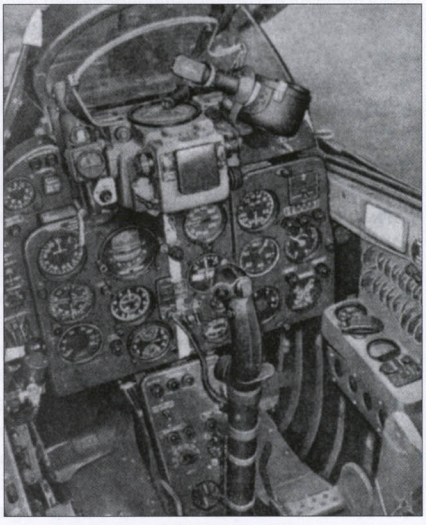
The instrument panels of the MiG-21F (*izdeliye* 72).

output rotary pump (*na**sos** porshne**voy***). The delivery pressure varies from 180 to 215 kg/cm² (2,570-3,070 psi); each pump has its own hydraulic accumulator with a maximum pressure of 50 kg/cm² (714 psi).

The *primary system* operates the landing gear, flaps, airbrakes, air intake shock cone and anti-surge doors, and engine nozzle actuators. It also operates one chamber of the tailplane actuator, acts as a back-up for the aileron

All photos Yefim Gordon archive

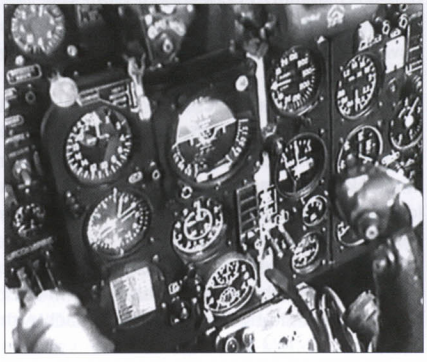


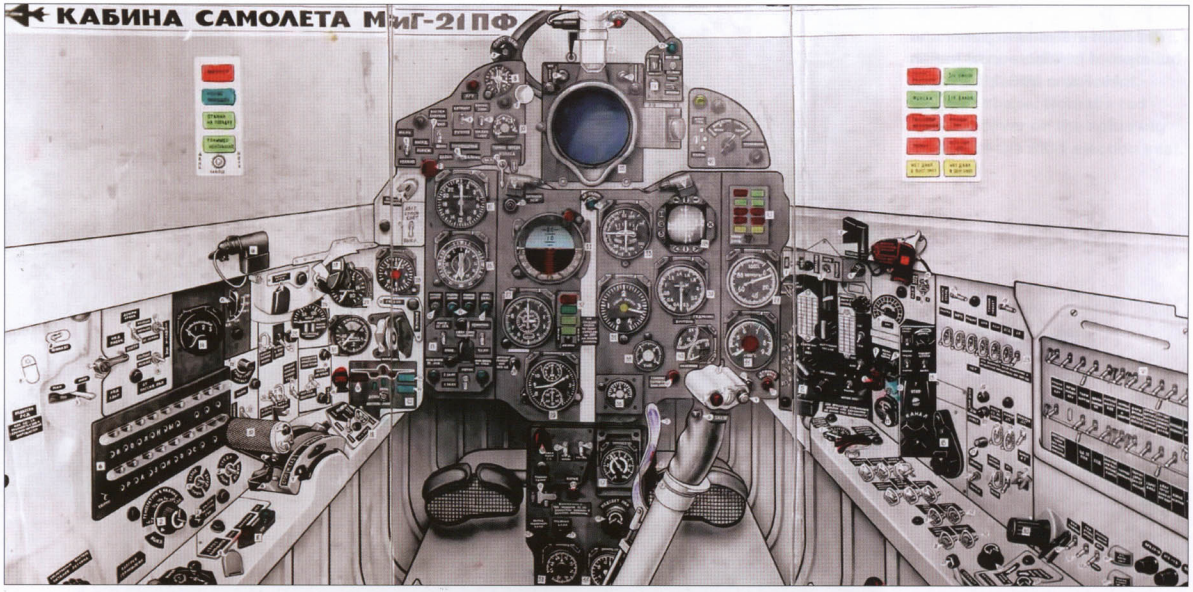


►▲
The cockpit of a MiG-21F.

▲►►
The instrument panel of a MiG-21F-13. The white line down the middle serves for aligning the control stick during spin recovery.

►
The ASP-5ND optical sight of the MiG-21F-13.





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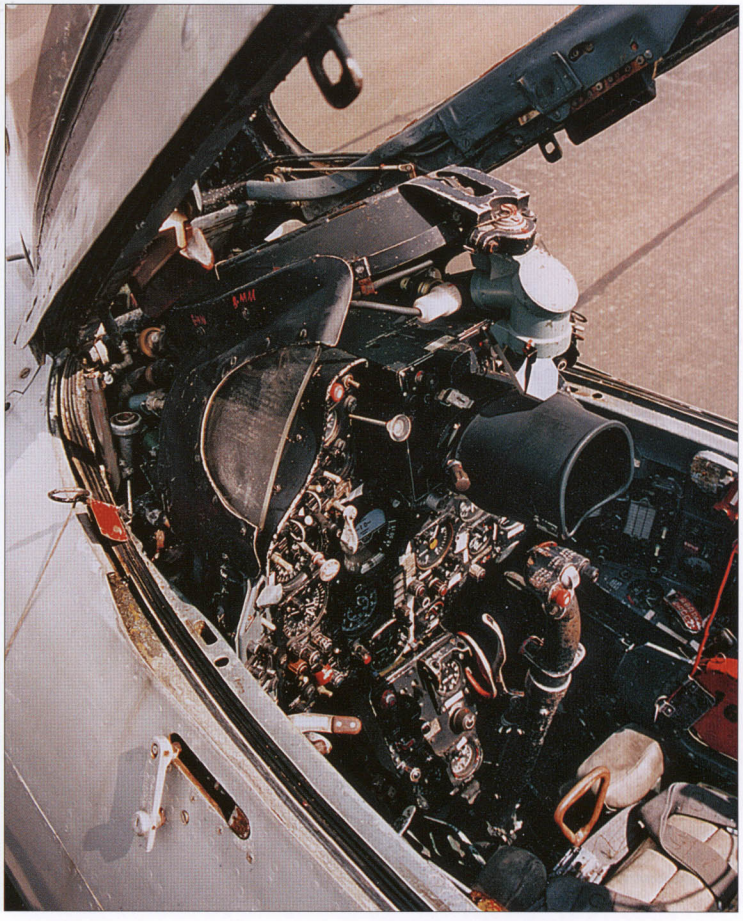
▲ **A placard showing the cockpit of the MiG-21PF. The caution/warning lights are shown separately.**



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▶ **The cockpit of a MiG-21PF. Note the fixed bulletproof windscreen, the gun camera attached to it and the radarscope with a rubber sunblind.**

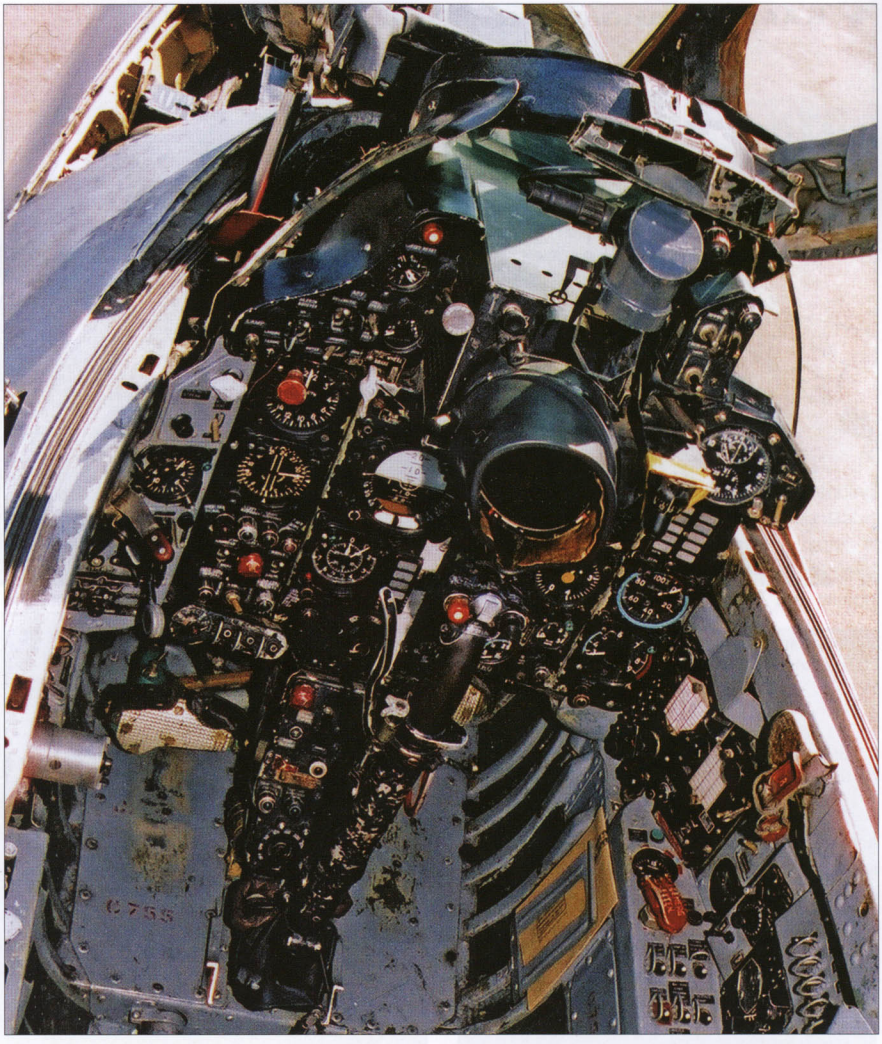
actuators, regulates the cooling air flow for the radio set and performs automatic wheel braking during landing gear retraction.

The *actuator supply system* caters exclusively for the aileron actuators and the other chamber of the tailplane actuator. Normally the latter is served by both systems; in the event one of the systems fails, the actuator remains operational but delivers only 50% power.

The systems use AMG-10 oil-type hydraulic fluid (*aviatsi**on**noye **mahs**lo ghidrav**lich**eskoye*). Total capacity of both systems is 36 litres (7.92 Imp gal). The hydraulic reservoir is divided by a vertical wall into two unequal sections for the primary and actuator supply systems holding 10.5 litres (2.31 Imp gal) and 7.2-8 litres (1.584-1.76 Imp gal) respectively; the tank is pressurised to 1.7-2.3 kg/cm² (24.28-32.85 psi). The hydraulic reservoir and valve units are located between frames 31-34 and this compartment is heat-insulated.

Electrics: 28.5 V DC main electrical system with a 12-kW GSR-ST-1200VT-2I starter/generator as the main power source. Backup DC power is provided by two 15STs-45A (28 V,

▶ **The main instrument panel and bulletproof windscreen of Indian Air Force MiG-21FL C755.**



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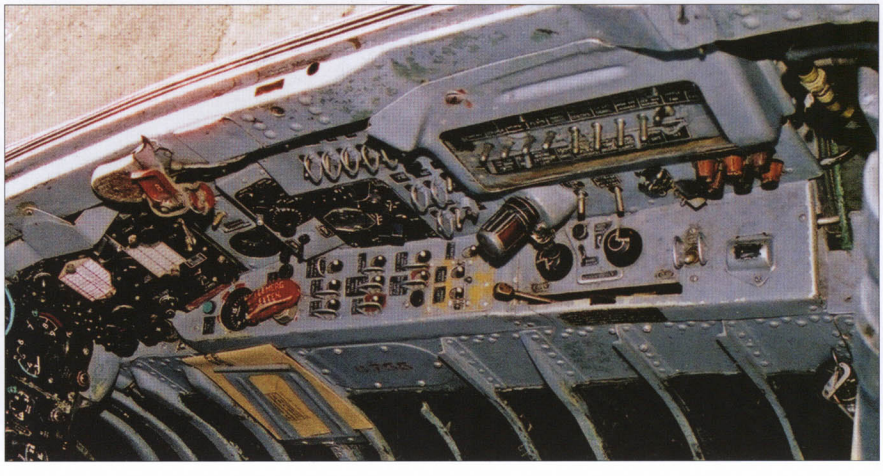

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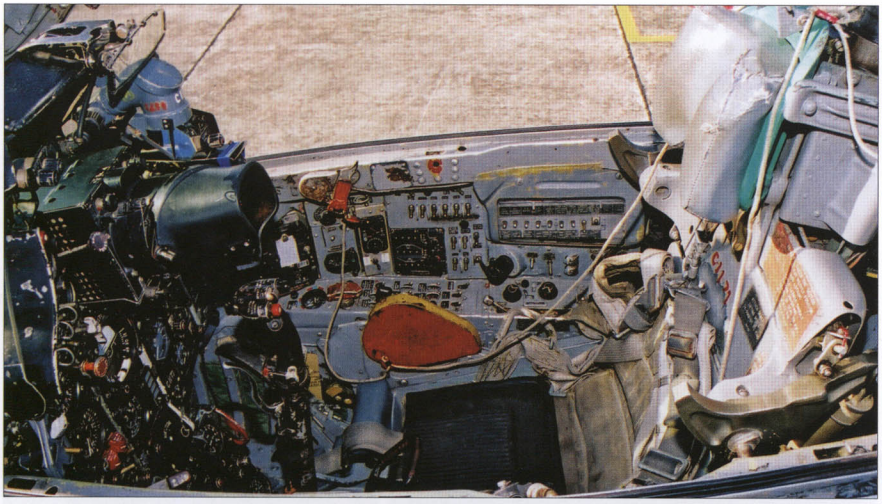
▶ **The starboard cockpit console of the same aircraft.**



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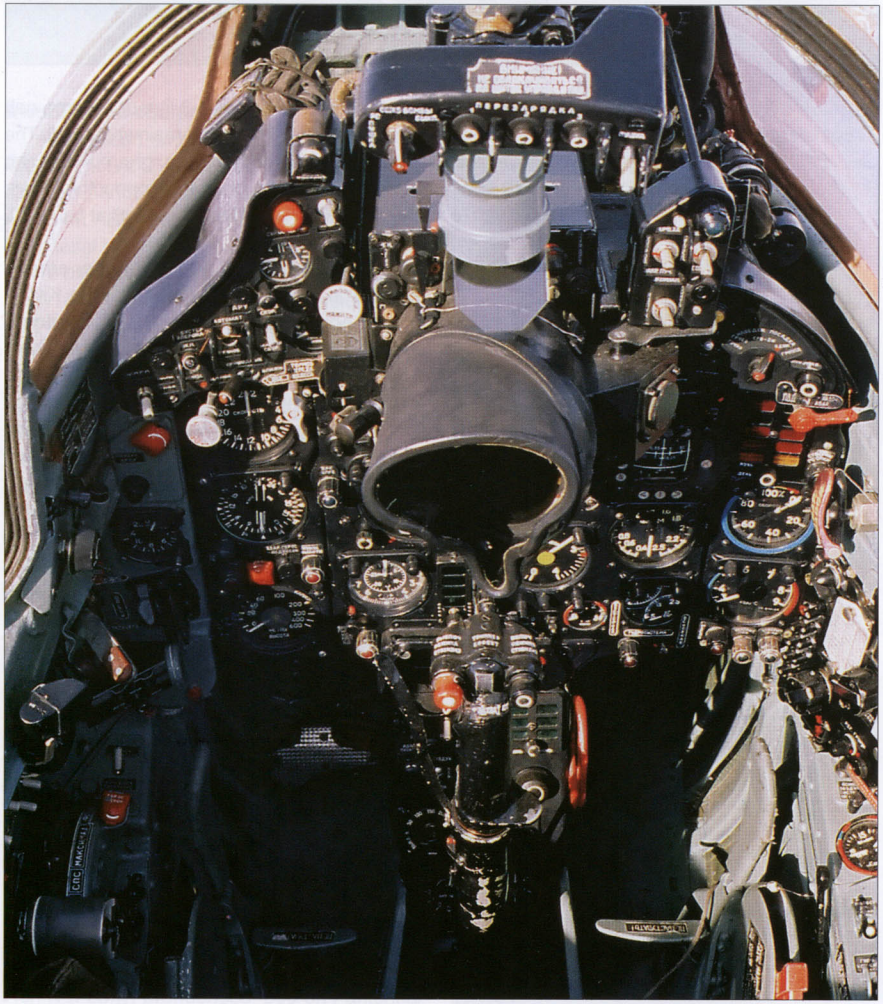
◄ The cockpit of MiG-21FL C1171. The rubber sunblind of the radarscope has a different, angular shape. Note the red ground cover on the actuating handle of the SK-1 ejection seat.



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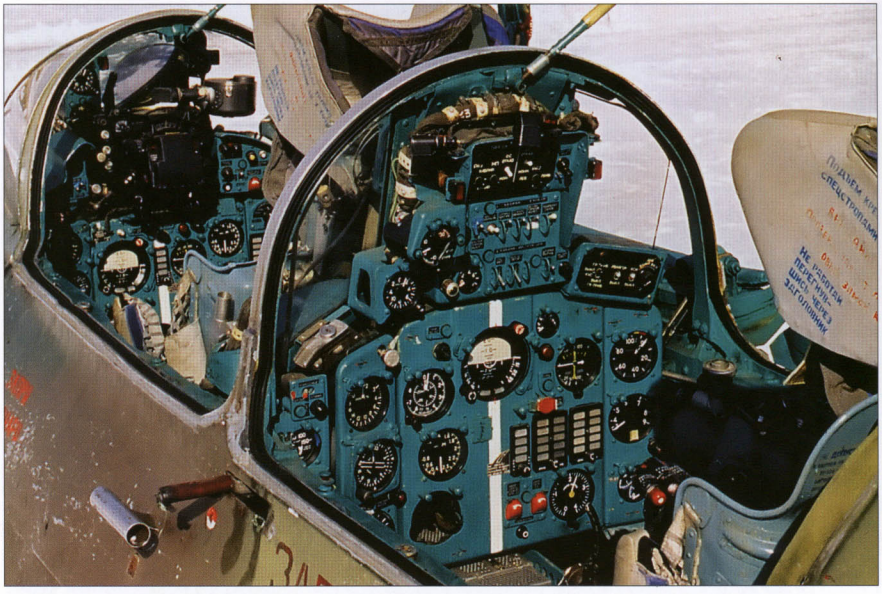
◄ The instrument panel of a late-production MiG-21PFM featuring a sideways-opening canopy and a KM-1 ejection seat.



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The cockpits of a MiG-21UM trainer. Note the control panel above the instructor's instrument panel allowing him to override the trainee's actions and provide systems failure inputs.

45 A·h) silver-zinc batteries in the forward avionics/equipment bay. 115 V/400 Hz single-phase AC power is provided by two converters, PO-1500VT-2I and PO-750A (*preobrazo**vah**tel' odno**fahz**nyy*); two more converters, PT-500Ts and PT-125Ts (*preobrazo**vah**tel' tryokh**fahz**nyy*), provide 36 V/400 Hz three-phase AC. These supplies serve all avionics and instrumentation, lighting and armament controls. The MiG-21PFM has a separate SGO-8 generator supplying 115 V AC. A ground power receptacle is located ahead of the port wing root.

Pneumatic system: Two subsystems (main and emergency). The *main system* actuates the wheel brakes, brake parachute deployment/release and is responsible for cockpit pressurisation; it also actuates the canopy's alcohol de-icing system. The *emergency system* is responsible for emergency landing gear extension (in the event of a hydraulics failure) and emergency braking.

Basic pressure in both systems is 110-130 kg/cm² (1,571-1,857 psi). Nosewheel brake pressure and mainwheel brake pressure is 15 kg/cm² (214 psi) and 19 kg/cm² (217 psi) respectively; emergency braking system pressure is 17.5 kg/cm² (250 psi).

Compressed air for the main system is supplied by two spherical 2-litre (0.44 Imp gal) air bottles and a cylindrical 4.4-litre (0.968 Imp gal) bottle in the starboard mainwheel well, plus two 2.23-litre (0.49 Imp gal) air reservoirs incorporated into the main gear struts. The emergency system is served by two 1.3-litre (0.286 Imp gal) spherical bottles in the port mainwheel well. The bottles are charged on the ground from an outside source; the charging connectors are in the starboard mainwheel wheel well at frame 20.

Oxygen system and high-altitude equipment: The MiG-21F/MiG-21F-13 has a KKO-3 oxygen equipment set (*kom**plekt** kislo**rod**novo obo**roo**dovaniya*) for high-altitude operations; the equipment also ensures pilot survival in the event of decompression. The KKO-3 comprises gaseous oxygen bottles (located in the mainwheel wells in the wings), pressure reduction gear, a KM-3-OM oxygen mask (*kislo**rod**naya **mahs**ka*), a KP-34 breathing apparatus (*kislo**rod**nyy pri**bor***) for normal operation and a KP-27M breathing apparatus used in the event of an ejection at high altitude.

The pilot is equipped with a VKK-4 pressure suit (*vy**sot**nyy kompen**see**ruyushchiy kos**tyum*** – altitude compensation suit) and a GSh-4M full-face pressure helmet (*ghermo**shlem***) permitting safe ejection at high altitude. Later versions feature the KKO-5 oxygen equipment set, VKK-6 pressure suit and GSh-6 pressure helmet.

Air conditioning and pressurisation system: The MiG-21 has a ventilation-type cockpit, which is pressurised to 0.25 kg/cm² (about 3.6 psi) and air-conditioned; the temperature is maintained at 15±5°C. On late versions the air conditioning system features a cooling turbine, an overpressure check valve, a shut-off cock,

an ARD-57V automatic pressure regulator (*avtomat**ich**eskiy regool**ya**tor dav**len**iya*), a TRTVK-45M temperature regulator and a connector for a mobile air handling unit. The canopy is sealed by an inflatable rubber hose.

Fire suppression system: A 2-litre (0.44 Imp gal) fire extinguisher bottle is located at frame 20, with a pyrotechnical valve and a steel manifold distributing the extinguishing agent in the engine bay, ensuring fire suppression in flight and on the ground. An IS-2MS (or, on late versions, IS-3) fire warning system is provided, with flame sensors installed at fuselage frame 29. System operation is manual.

De-icing system: On early versions the cockpit windshield is equipped with an ethyl alcohol de-icing system featuring a 4.5-litre (1 Imp gal) tank in the forward avionics/equipment bay, a spray manifold and pneumatic valve. The tank is pressurised to 3 kg/cm² (42.85 psi).

Avionics and equipment:

• *navigation and guidance equipment:* The MiG-21F/MiG-21F-13 has an ARK-10 automatic direction finder (early MiG-21Fs had an ARK-54M ADF) with omnidirectional aerial and loop aerial buried in the underside of the nose, an RV-UM radio altimeter with two dipole aerials (early MiG-21Fs had the RV-U version), and MRP-56P marker beacon receiver. The latter's aerial is located between frames 30-31.

All radar-equipped interceptor versions of the MiG-21 feature a ground controlled intercept (GCI) command link system. Usually it is the ARL-S (the Lazoor' version on the MiG-21PF, MiG-21PFS, MiG-21PFM and MiG-21FL, or the Lazoor'-M variety on the MiG-21S *et seq.*); it is part of the Vozdukh-1 GCI system. The MiG-21*bis* *Fishbed-N* is the only exception, being equipped with the Polyot-OI suite which functions both as a command link system and as a short-range radio navigation system/ILS; it is incompatible with the ARL-S system, which had to be removed.

The Polyot-OI suite permits landing approach in automatic and flight director modes down to 50-60 m (165-200 ft) in any weather, working with the radio beacons of the RSBN-2N or RSBN-4N SHORAN system and the PRMG-4 ***Ka**tet-S* (Cathetus-S) localiser/glide slope beacon system. This enhances navigation accuracy appreciably. The suite comprises the SAU-23ESN automatic flight control system, the RSBN-5S SHORAN/approach system and the Pion-N (Peony, pronounced 'pee on') antenna/feeder system. It is integrated with the AGD-1 gyro horizon, the KSI compass system (*koor-so**va**ya si**stem**a istre**bit**el'naya*), the DVS-10 airspeed sensor (***daht**chik voz**doosh**noy **sko**rosti*) and the DV-30 altitude sensor (***daht**chik vy**soty***). The SAU-23ESN consists of a processor, a command display unit and an autopilot receiving inputs from the processor.

• *communications equipment:* The MiG-21F-13 featured an R-802V (RSIU-5) two-way VHF radio in the forward avionics/equipment bay with a blade aerial aft of the cockpit. On later versions it was replaced by an RSIU-4M, RSIU-4V or R-800 VHF radio.

• *IFF equipment:* SRZO-2 Khrom-Nikel' (NATO *Odd Rods*) IFF interrogator/transponder

The cockpit of a Czech Air Force MiG-21MFN featuring Western navigation system controls and a digital altimeter giving the altitude in feet.
▼

Martin Novak

Yefim Gordon

▲ **The cockpit of a standard MiG-21*bis*.**

The cockpit of the MiG-21-93 with a multi-function display. ▼

Yefim Gordon

with triple rod aerials aft of the nose gear unit (MiG-21F/MiG-21F-13 and the trainers) or on top of the nose (all other versions) and at the tip of the fin, plus SOD-57M decimetre-waveband ATC transponder.

• *targeting equipment:* The MiG-21F is fitted with an ASP-5NV-U1 computing gunsight linked to an SRD-5M Kvant radar rangefinder, whose antenna is housed in the air intake centrebody, and the SIV-52 forward-looking IR sensor. The MiG-21F-13 has an ASP-5ND or ASP-5NM sight linked to an SRD-5ND or SRD-5M radar rangefinder.

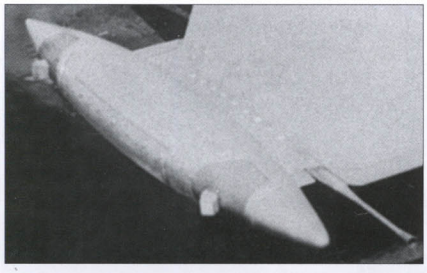
Fighter versions from the MiG-21PF onwards are equipped with fire control radars; the radar set and scanner are again housed in the intake centrebody. The MiG-21PF, early batches of the MiG-21PFS and the MiG-21R have an RP-21 radar (aka TsD-30TP or *izdeliye* 830) and a PKI (aka ASP-PF-21) collimator sight. Late production MiG-21PFS, MiG-21PFM and MiG-21R aircraft have an RP-21M or RP-21MA (*izdeliye* 830M or 830MA) radar. The MiG-21M is likewise fitted with the RP-21MA version. For export to third-world countries, the RP-21 and RP-21M/RP-21MA radars were referred to as the R1L and R2L respectively.

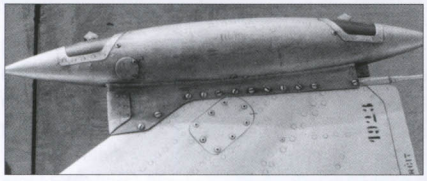
The MiG-21S and most of the later single-seaters (MiG-21SM/MiG-21MF, MiG-21SMT and MiG-21MT) have the RP-22 Sapfeer-21 radar (aka S-21; often called RP-22S in Soviet/Russian Air Force documents) working with the ASP-PFD optical sight. The MiG-21*bis* has the improved RP-22M Sapfeer-21M (aka S-21M) radar.

The trainer versions lack radar equipment. On the MiG-21U and MiG-21US the weapons aimed by means of an ASP-5NM gunsight (replaced by the ASP-PFD on the MiG-21UM).

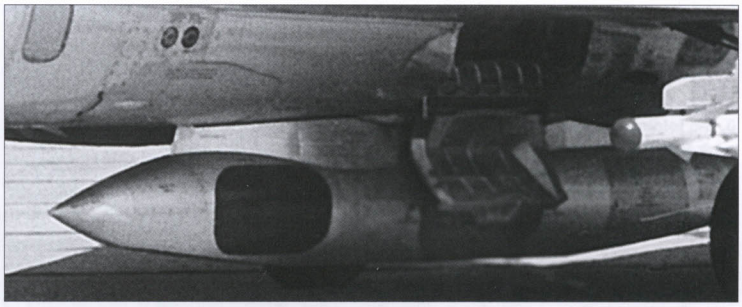
• *electronic support measures equipment:* The MiG-21F/MiG-21F-13 and MiG-21PF/PFS are equipped with a Sirena-2 radar homing and warning system (RHAWS). All versions from the MiG-21PFM onwards feature the SPO-3M Sirena-3M RHAWS. The system's aerials are located on the fin and at the wingtips. The RHAWS is mounted internally, except on the MiG-21R where it is housed in the mission equipment pods – see below.

• *reconnaissance equipment:* Virtually all versions from the MiG-21F-13 onwards have provisions for installing a single AFA-39 vertical camera replacing one of the wing-mounted landing/taxi lights. The specialised MiG-21R reconnaissance aircraft carries interchangeable mission equipment pods on the centreline pylon. The Type R ELINT pod houses SRS-6 Romb-4A and SRS-7 Romb-4B ELINT sets, a tape recorder capturing ELINT data, an AFA-39 camera for identifying the location and an SPO-3 Sirena-3 RHAWS. The Type D day PHOTINT pod houses two oblique AFA-39 cameras, four vertical AFA-39 cameras, an AFA-5 (or AShchAFA) slit

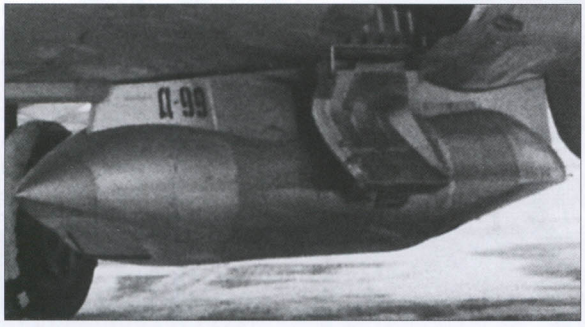




▲
The wingtip pods housing RHAWS antennas which are fitted to the MiG-21R in reconnaissance configuration.



All photos Yefim Gordon archive



camera and the same tape recorder and RHAWS. The Type N night PHOTINT pod accommodates an NAFA-47 night camera and 188 photo illumination flares.

• *exterior lighting:* BANO-45 port and starboard navigation lights (*borto**voy** **a**eronaviga-tsi**on**nyy o**gon***') on the wing leading edge well inboard of the wingtips; white tail navigation light on the fin trailing edge. Early MiG-21Fs and MiG-21F-13s had a single landing/taxi light on the nose gear unit; all later aircraft had two retractable landing/taxi lights in the wing roots aft of the mainwheel wells between ribs 1 and 2.

Armament:

• *cannon armament:* The MiG-21 *sans suffixe* was armed with three staggered 30-mm (1.18 calibre) Nudel'man/Rikhter NR-30 (*izdeliye* 235P) cannons with 30 rpg; the centre cannon was offset to starboard and mounted aft of the port and starboard ones. The MiG-21F (and J-7) has two NR-30 cannons (port and starboard), again with 30 rpg, the centre cannon being eliminated; on the MiG-21F-13 (S-106, J-7 I) the cannon armament is restricted to a single NR-30 with 30 rounds on the port side.

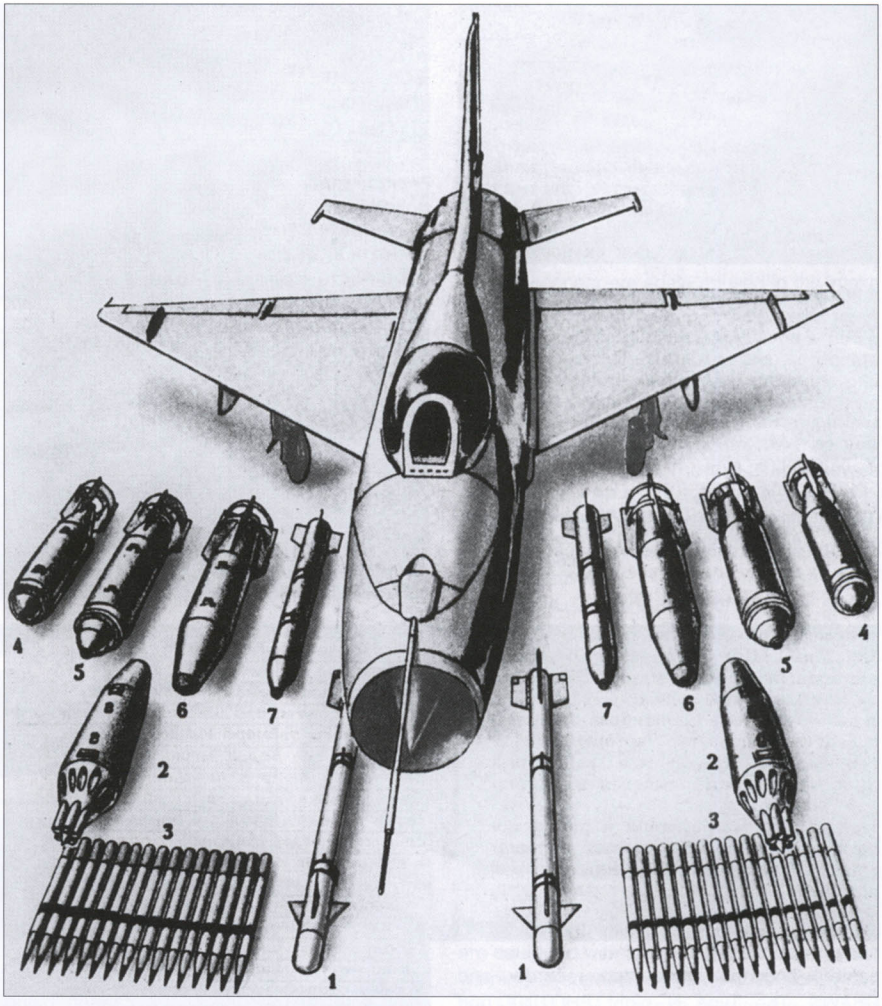
The MiG-21PF, MiG-21PFS and early production MiG-21PFMs, as well as the MiG-21R reconnaissance version, lack cannons. Late-production MiG-21PFMs, the MiG-21FL and MiG-21S have provisions for carrying a GP-9 (or GP-9S) centreline cannon pod housing a 23-mm (.90 calibre) Gryazev/Shipunov GSh-23 twin-barrel cannon with 200 rounds. The GSh-23 weighs 51 kg (112 lb) and fires 200-gm (7.06-oz.) shells at a rate of 3,400 rounds per minute; the muzzle velocity is 700 m/sec (2,297 ft/sec). Installation of the GP-9 pod requires the centreline pylon to be removed, precluding carriage of a drop tank.

On single-seat versions from the MiG-21M onwards (including the MiG-21SM/MiG-21MF,

▲◄ ▲
The type D daylight PHOTINT pod with the camera ports closed. Note how the rear end of the integral pylon fits around the bulged rear airbrake.

▲▲
The Type R ELINT pod on a ground handling dolly with protective covers over the dielectric panels.

▲▲▲
A Type R pod suspended under a MiG-21R.



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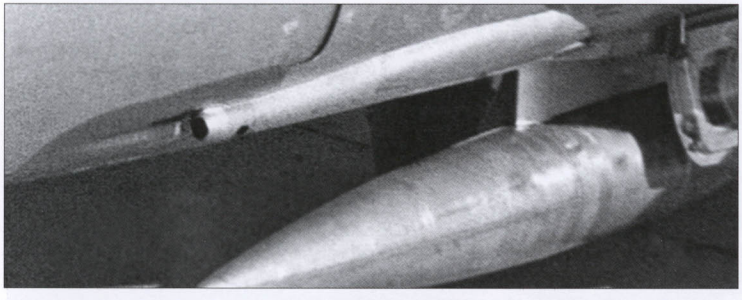
▶
A drawing showing the weapons options of the MiG-21PF. 1. R-3S air-to-air missiles. 2. UB-16-57UM rocket pods. 3. S-5 folding-fin aircraft rockets. 4. FAB-100 bombs. 5. FAB-250 bombs. 6. ZB-360 napalm tanks. 7. S-24 unguided rockets.

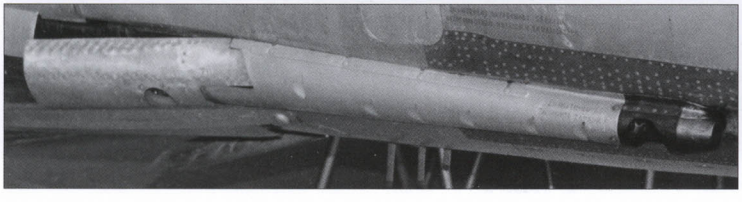
A UB-16-57U FFAR pod with conical nose and flush launch tubes suspended on the port BD3-58-21 pylon of a MiG-21F.
▶▼

The port NR-30 cannon of a MiG-21F. Note the steel blast plate.
▼

The starboard cannon of a MiG-21F or MiG-21F-13 featuring a modified muzzle brake. Note the airbrake curved to match the shape of the cannon fairing.
▼



RSK MiG



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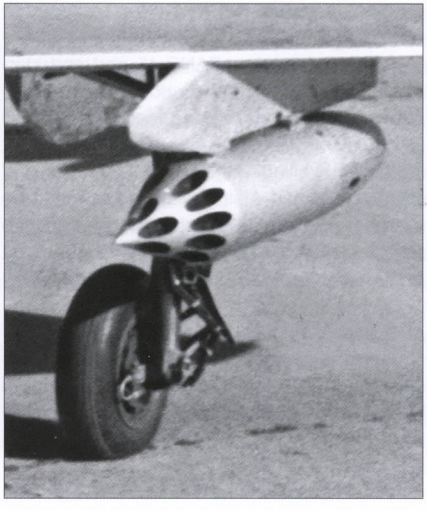

RSK MiG

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◄◄ **A 250-kg FAB-250 HE bomb with a ballistic collar under the port wing of a MiG-21F-13.**

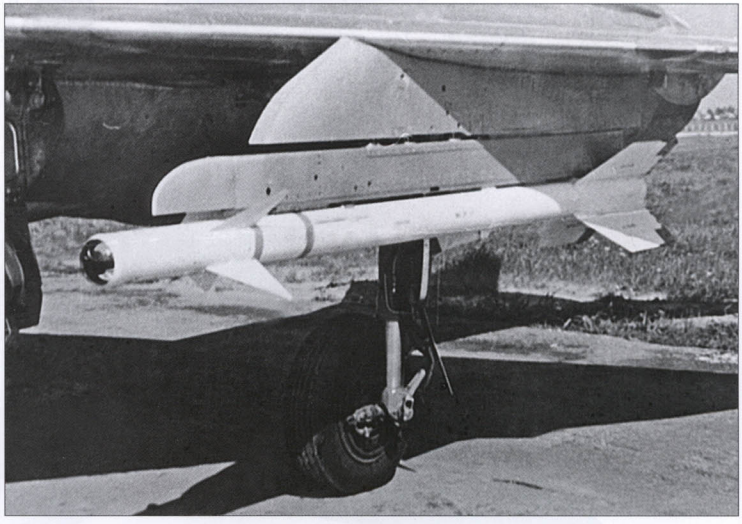
◄ **A ZB-360 napalm tank under the port wing of a MiG-21F-13.**

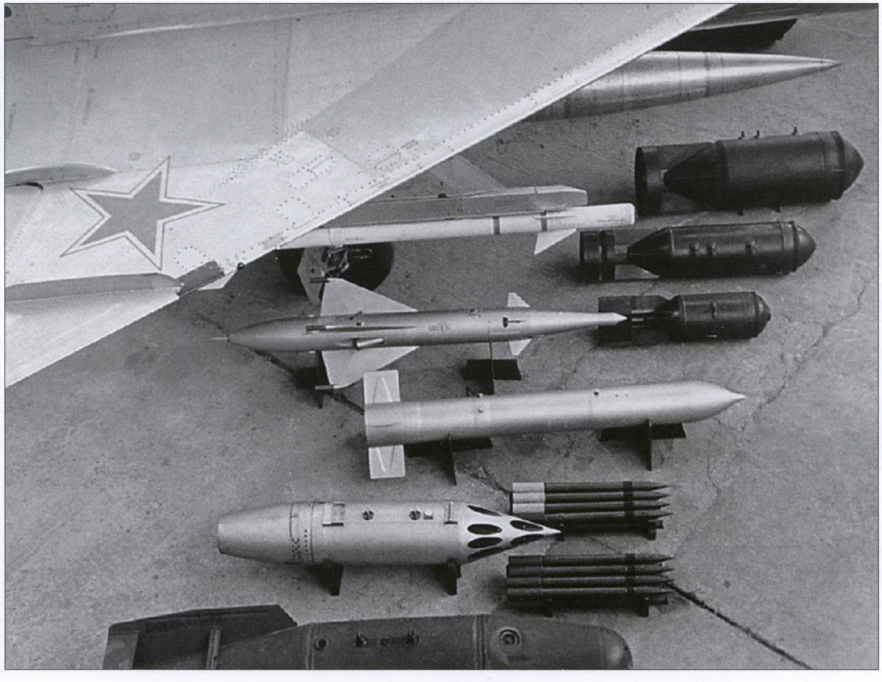
MiG-21MT, MiG-21SMT and MiG-21*bis*) a built-in GSh-23L cannon is mounted in a shallow fairing under the centre fuselage, again with an ammunition supply of 200 rounds.

The trainer versions can carry a single 12.7-mm (.50 calibre) Afanas'yev A-12,7 machine-gun in a removable GP-A-12,7 conformal pod under the centre fuselage.

• *air-to-air weapons:* The MiG-21F-13 carries two K-13 or K-13A (alias R-3S) IR-homing air-to-air missiles on underwing APU-13 launch rails (early examples had APU-28 missile rails). The K-13A (R-3S) has a 'kill' range of 1-7 km (0.62-4.35 miles).

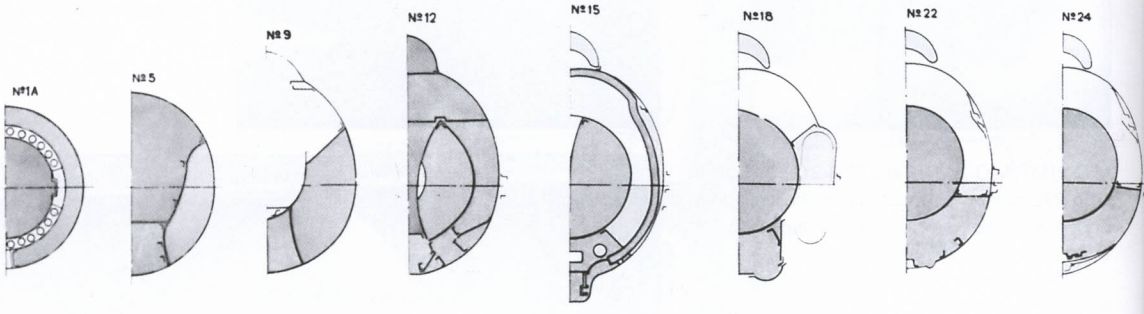
The MiG-21PF/MiG-21PFS, MiG-21PFM and MiG-21FL likewise carry two R-3S AAMs on APU-13 missile rails. The MiG-21S can carry up to four R-3S or R-3R AAMs (the latter version has semi-active radar homing). Fighter versions from


RSK MiG


RSK MiG

▲ **A K-13 missile on an APU-28 launch rail carried by an early MiG-21F-13 (note the curved leading edge of the pylon).**

◄ **Weapons arrayed beside a MiG-21PFS carrying R-3S AAMs and a PTB-490 drop tank. Top to bottom: FAB-250, FAB-100 and FAB-50 bombs, RS-2-US AAM, S-24 unguided rocket, UB-16-57U rocket pod with S-5 FFARs, and ZB-360 napalm tank.**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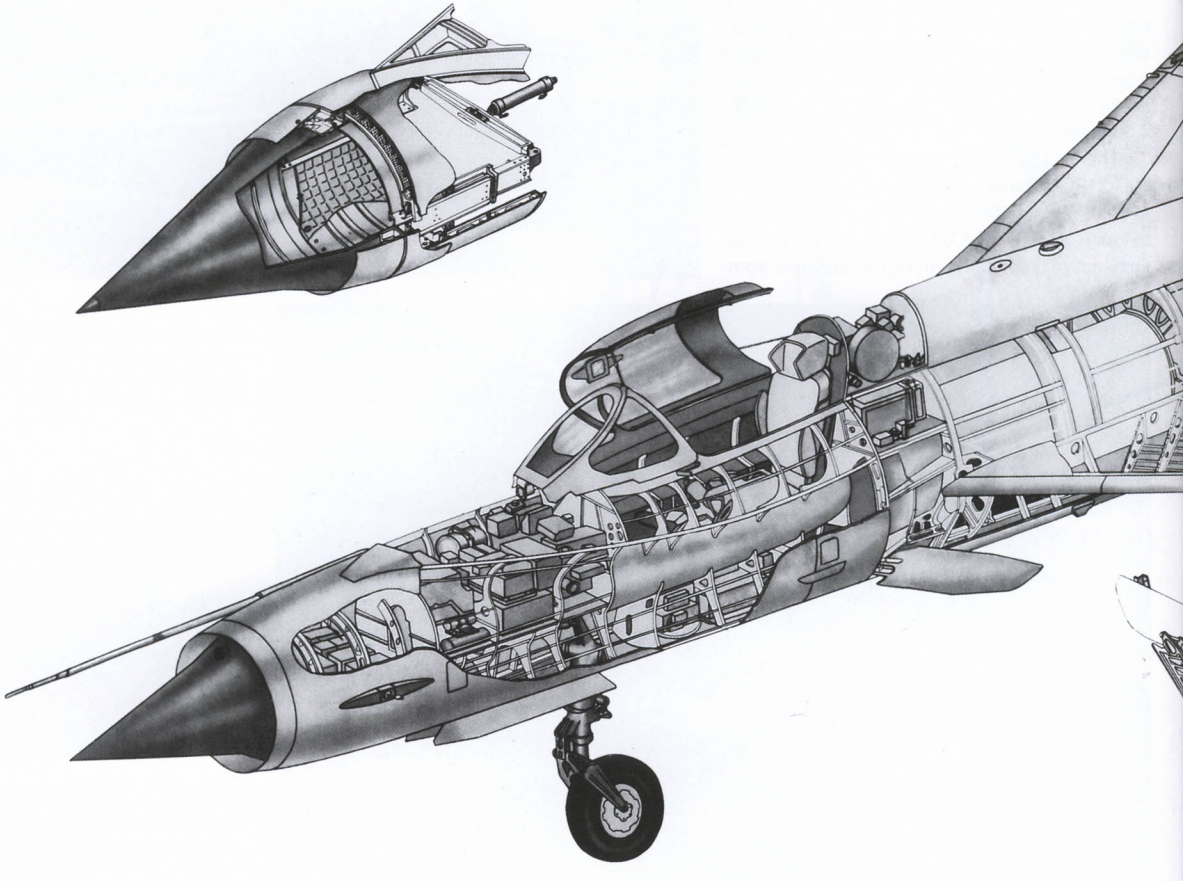

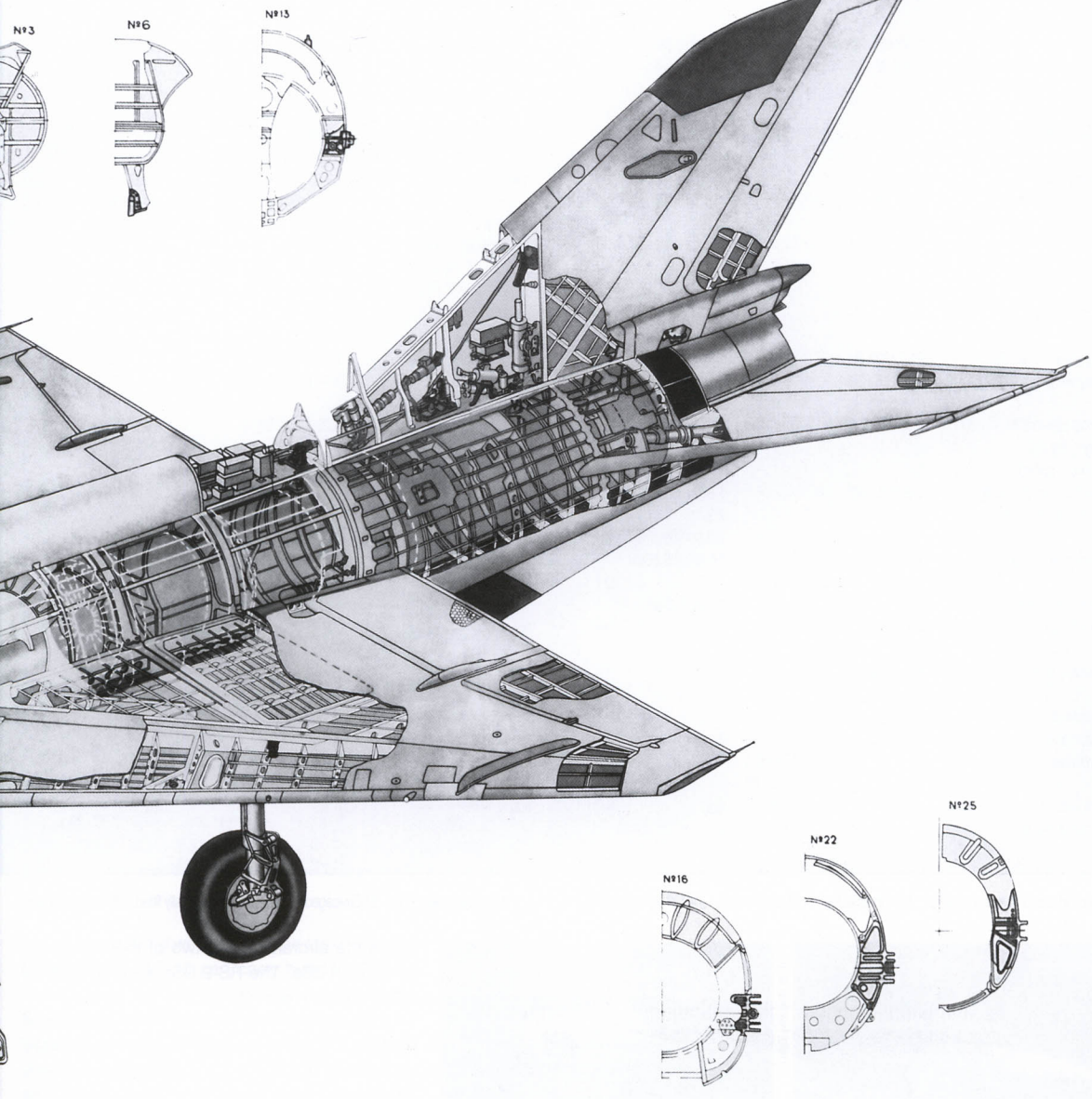

A schematic cutaway drawing of the MiG-21bis from Mikoyan OKB documents, with scrap views of fuselage cross-sections along specific fuselage frames. The shape of the spine resembles the MiG-21SM/MiG-21MF, but the location of the fuel tanks and equipment corresponds to that of the MiG-21bis.

Specifications of experimental and production aircraft in the MiG-21 family

	Ye-2	Ye-2A	Ye-4	Ye-5 (MiG-21)	Ye-50-2
Year	1955	1956	1955	1956	1956
Powerplant	AM-9B	RD-11	AM-5	RD-11 (R11-300)	RD-11 + S-155
Thrust, kgp (lbst):					
dry	2,600 (5,730) ‡‡	3,800 (8,380)	2,000 (4,410)	3,800 (8,380)	3,800 (8,380)
reheat	3,250 (7,165)	5,100 (11,240)	n.a.	5,100 (11,240)	5,100 + 4,040 (11,240 + 8,910)
Length overall:					
including pitot	n.a.	n.a.	n.a.	15.545 m (51 ft 0 in)	n.a.
less pitot	13.23 m (43 ft 4⅝ in)	13.23 m (43 ft 4⅝ in)	n.a.	13.23 m (43 ft 4⅝ in)	13.625 m (44 ft 8⅛ in)
Wing span	8.1098 m (26 ft 7⅞ in)	8.1098 m (26 ft 7⅞ in)	7.754 m (25 ft 5⅝ in)	7.754 m (25 ft 5⅝ in)	8.1098 m (26 ft 7⅞ in)
Horizontal tail span					
Height on ground	n.a.	n.a.	n.a.	n.a.	n.a.
Wing area, m² (sq. ft)	21.0 (225.8)	21.0 (225.8)	23.13 (248.7)	23.13 (248.7)	21.0 (225.8)
Empty weight, kg (lb)	3,687 (8,128)	4,340 (9,570)	n.a.	4,443 (9,794)	n.a.
Normal take-off weight, kg (lb)	5,334 (11,759)	6,250 (13,780)	n.a.	6,230 (13,730)	8,500 (18,740)
Maximum speed at altitude, km/h (mph)	1,920 (1,192)	1,900 (1,180)	1,296 (805)	1,970 (1,223)	2,470 (1,534)
Time to height, minutes (m/ft)	n.a.	7.3 (10,000/32,810)	n.a.	1.6 (5,000/16,400)	9.4 (20,000/65,620)
Service ceiling, m (ft)	19,000 (62,335)	18,000 (59,055)	16,400 (53,805)	17,650 (57,910)	25,580 (83,920) *
Range, km (miles)	n.a.	2,000 (1,242)	1,120 (695)	1,313 (815)	450 (279)
Take-off run, m (ft)	700 (2,300)	n.a.	n.a.	730 (2,400)	2,000-2,200 (6,560-7,220) **
Landing run, m (ft)	800 (2,620)	n.a.	n.a.	890 (2,920)	1,100-1,300 (3,610-4,265)
Armament:					
cannons	3 x NR-30	3 x NR-30	3 x NR-30	3 x NR-30	2 x NR-30 ††
missiles	–	–	–	–	–
rockets	n.a.	n.a.	n.a.	n.a.	n.a.
bombs, kg (lb)	–	–	–	–	–

* In a zoom climb (dynamic ceiling) † On internal fuel ‡ Machine-gun § In GP-9 pod (late batches only) ** Turbojet power only †† Envisaged by project but not actually fitted ‡‡ Nominal power

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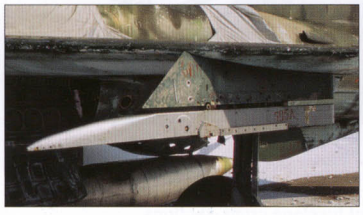

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▲ **APU-13 (left) and APU-7 launch rails for the R-3 and the RS-2-US missiles respectively.**

the MiG-21M onwards also carry up to four AAMs – usually a mix of R-3S and R-3R models.

RS-2-US beam-riding AAMs could be used instead of R-3Rs but were rarely carried; in such cases the aircraft carried two of these missiles and two R-3Ss. The RS-2-USs were carried on APU-7 launch rails.

Instead of R-3Ss, the MiG-21*bis* carries four R-60 or R-60M IR-homing medium-range AAMs on APU-60-2 paired launchers attached to the outer pylons; this increases the total number of missiles carried by this version to six. The MiG-21*bis* could also carry four R-55 AAMs, but this missile was produced on a very small scale and hardly saw service at all.

The trainer versions can carry two R-3S AAMs in case of need.

MiG-21F	MiG-21F-13	MiG-21PF	MiG-21U	Ye-8/1	MiG-21PFM
1958 R11F-300	1959 R11F-300	1960 R11F2-300	1961 R11F-300	1962 R21F-300	1963 R11F2S-300
3,800 (8,380) 5,740 (12,650)	3,800 (8,380) 5,740 (12,650)	3,950 (8,710) 6,120 (13,490)	3,800 (8,380) 5,740 (12,650)	4,700 (10,360) 7,200 (15,870)	3,950 (8,710) 6,175 (13,610)
15.76 m (51 ft 8½ in) 13.46 m (44 ft 1¾ in) 7.154 m (23 ft 5½ in)	15.76 m (51 ft 8½ in) 13.46 m (44 ft 1¾ in) 7.154 m (23 ft 5½ in)	14.5 m (47 ft 6¾ in) 14.1 m (46 ft 3⅛ in) 7.154 m (23 ft 5½ in) 2.6 m (8 ft 6¾ in)	15.76 m (51 ft 8½ in) 13.46 m (44 ft 1¾ in) 7.154 m (23 ft 5½ in)	n.a. 14.9 m (48 ft 10¾ in) 7.154 m (23 ft 5½ in)	14.5 m (47 ft 6¾ in) 14.1 m (46 ft 3⅛ in) 7.154 m (23 ft 5½ in)
4.1 m (13 ft 5⅜ in) 23.0 (247.3) 4,819 (10,623) 6,850 (15,100)	4.1 m (13 ft 5⅜ in) 23.0 (247.3) 4,871 (10,738) 7,100 (15,650)	4.125 m (13 ft 6⅜ in) 23.0 (247.3) n.a. 7,750 (17,085)	n.a. 23.0 (247.3) n.a. 7,800 (17,195)	n.a. 23.0 (247.3) 6,800 (14,990) 8,000 (17,640)	4.125 m (13 ft 6⅜ in) 23.0 (247.3) n.a. 7,800 (17,195)
2,175 (1,350) 7.5 (18,500/60,695) 19,000 (62,335) n.a. 900 (2,950) 800 (2,620)	2,175 (1,350) 13.5 (19,000/62,335) 19,000 (62,335) 1,580 (981) 900 (2,950) 900 (2,950)	2,175 (1,350) 6.2 (10,000/32,810) 19,000 (62,335) 1,900 (1,180) 900 (2,950) 850 (2,790)	2,175 (1,350) 8.0 (17,800/58,400) 18,300 (60,040) 1,210 (751) † 950 (3,120) 800 (2,620)	2,230 (1,385) n.a. 20,300 (66,600) n.a. 835 (2,740) 850 (2,790)	2,230 (1,385) 8.0 (18,500/60,695) 19,000 (62,335) 1,670 (1,037) 950 (3,120) 950 (3,120)
2 x NR-30 – 32 x S-5M or S-5K 2 x 500 (2 x 1,102)	1 x NR-30 2 x K-13 or K-13A (R-3S) n.a. 2 x 500 (2 x 1,102)	– 2 x K-13A (R-3S) 32 x S-5M or S-5K 2 x 500 (2 x 1,102)	1 x A-12.7 ‡ 2 x R-3S n.a. –	– 2 x R-3S n.a. 2 x 500 (2 x 1,102)	1 x GSh-23 § 2 x R-3S n.a. 2 x 500 (2 x 1,102)

• *air-to-ground weapons:* In the strike role the MiG-21F/MiG-21F-13 can carry two UB-16-57U rocket pods holding sixteen 57-mm (2.24-in) S-5M (ARS-57M) folding-fin aircraft rockets with high-explosive/fragmentation warheads or S-5K (KARS-57) FFARs with shaped-charge armour-piercing warheads each. The pods are carried on BD3-58-21 pylons with BD3-55T (some sources say DZ-57) shackles. Alternatively, two 212-mm (8.34-in) ARS-212M (S-21) heavy unguided rockets on APU-O-212 launchers or two 240-mm (9.44-in) ARS-240 (S-24) unguided rockets on PU-12-40 launchers could be carried.

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▲
A K-13A missile on a late-model launch rail.

Free-fall weapons included two bombs of up to 500-kg (1,102-lb) calibre. In practice, the MiG-21F/MiG-21F-13 carried 50-kg (110-lb) FAB-50, 100-kg (220-lb) FAB-100 or 250-kg

Specifications of experimental and production aircraft in the MiG-21 family (continued)

	MiG-21R	MiG-21S	'23-31' (Ye-7PD)	MiG-21SM	MiG-21M
Year	1964	1964	1966	1967	1968
Powerplant	R11F2S-300	R11F2S-300	R13-300 + 2 x RD36-35	R13-300	R11F2SK-300
Thrust, kgp (lbst):					
dry	3,950 (8,710)	3,950 (8,710)	4,070 (8,970) + 2 x 2,350 (2 x 5,180)	4,070 (8,970)	3,950 (8,710)
reheat	6,175 (13,610)	6,175 (13,610)	6,490 (14,310)	6,490 (14,310)	6,175 (13,610)
Length overall:					
including pitot	15.0 m (49 ft 2 3/64 in)	15.0 m (49 ft 2 3/64 in)	n.a.	15.0 m (49 ft 2 32/64 in)	15.0 m (49 ft 2 32/64 in)
less pitot	14.1 m (46 ft 3 1/8 in)	14.1 m (46 ft 3 1/8 in)	n.a.	14.1 m (46 ft 3 1/8 in)	14.1 m (46 ft 3 1/8 in)
Wing span	7.154 m (23 ft 5 21/32 in)	7.154 m (23 ft 5 21/32 in)	7.154 m (23 ft 5 21/32 in)	7.154 m (23 ft 5 21/32 in)	7.154 m (23 ft 5 21/32 in)
Height on ground	n.a.	4.125 m (13 ft 6 13/32 in)	4.125 m (13 ft 6 13/32 in)	n.a.	n.a.
Wing area, m² (sq. ft)	23.0 (247.3)	23.0 (247.3)	n.a.	23.0 (247.3)	23.0 (247.3)
Empty weight, kg (lb)	n.a.	n.a.	n.a.	n.a.	n.a.
Normal TOW, kg (lb)	8,100 (17,860)	8,150 (17,970)	n.a.	8,300 (18,300)	8,200 (18,080)
Maximum speed at altitude, km/h (mph)	1,700 (1,055)	2,230 (1,385)	n.a.	2,230 (1,385)	2,230 (1,385)
Time to height, minutes (m/ft)	8.5 (14,600/47,900)	8.5 (17,500/57,410)	n.a.	9.0 (17,500/57,410)	9.0 (16,800/55,120)
Service ceiling, m (ft)	15,100 (49,540)	18,000 (59,055)	n.a.	18,000 (59,055)	17,300 (56,760)
Range, km (miles)	1,600 (993)	1,240 (770) †	n.a.	1,050 (652) †	1,050 (652) †
Take-off run, m (ft)	900 (2,950)	900 (2,950)	n.a.	800 (2,620)	900 (2,950)
Landing run, m (ft)	550 (1,800)	550 (1,800)	n.a.	550 (1,800)	550 (1,800)
Armament:					
cannons	–	1 x GSh-23 §	–	1 x GSh-23	1 x GSh-23
missiles	2 x R-3S	2-4 x R-3S	–	2 x R-3S 2 x R-3R	2 x R-3S 2 x R-3R
rockets	–		–		
bombs, kg (lb)	–	2 x 500 (2 x 1,102)	–	2 x 500 (2 x 1,102)	2 x 500 (2 x 1,102)

† On internal fuel ‡ Machine-gun § In GP-9 pod

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▲ **A Polish MiG-21M loaded with RS-2-US and K-13A missiles.**

▶ **An RS-2-US; note the guidance aerial on the tailcone.**

(551-lb) FAB-250 high-explosive bombs – or two ZB-360 napalm tanks.

The MiG-21PF, MiG-21PFS, MiG-21PFM, MiG-21FL and MiG-21S carry UB-16-57UM FFAR pods. These can be loaded with S-5M1, S-5K1, S-5-O and S-5P rockets. Two S-24 heavy unguided rockets can also be carried. The bomb armament is identical to the MiG-21F's. Versions from the MiG-21PFM (*izdeliye* 94N) onwards are able to carry an RN-25 tactical nuclear bomb on a special centreline pylon.

Fighter versions from the MiG-21M onwards can also use 32-round UB-32 pods, likewise loaded with 57-mm FFARs; a combination of two UB-16-57Us and two UB-32s is sometimes carried. Up to 1,000 kg (2,205 lb) of bombs or ZB-62 napalm tanks can be carried on the four wing pylons.

All versions from the MiG-21PFM onwards can carry Kh-66 air-to-surface missiles. Yet this missile proved to be less than effective when used by the MiG-21 and thus was rarely carried.

MiG-21I (Analogue)	MiG-21US	MiG-21MF	MiG-21SMT	MiG-21*bis*	MiG-21UM	MiG-21-93
1968 R13-300	1969 R11F2S-300	1970 R13-300	1970 R13-300	1971 R25-300	1971 R11F2S-300	1992 R25-300
4,070 (8,970)	3,950 (8,710)	4,070 (8,970)	4,070 (8,970)	4,100 (9,040)	3,950 (8,710)	4,100 (9,040)
6,490 (14,310)	6,175 (13,610)	6,490 (14,310)	6,490 (14,310)	7,100 (15,650)	6,175 (13,610)	7,100 (15,650)
n.a.	15.76 m (51 ft 8½ in)	15.0 m (49 ft 2⅜ in)	15.0 m (49 ft 2⅜ in)	15.0 m (49 ft 2⅜ in)	15.76 m (51 ft 8½ in)	14.5 m (47 ft 6⅝ in)
14.7 m (48 ft 2⅞ in)	13.46 m (44 ft 1⅝ in)	14.1 m (46 ft 3 1/8 in)	14.1 m (46 ft 3⅛ in)	14.1 m (46 ft 3⅛ in)	13.46 m (44 ft 1⅝ in)	14.1 m (46 ft 3¼ in)
8.15 m (26 ft 8⅝ in)	7.154 m (23 ft 5½ in)	7.154 m (23 ft 5½ in)	7.154 m (23 ft 5½ in)	7.154 m (23 ft 5½ in)	7.154 m (23 ft 5½ in)	7.154 m (23 ft 5½ in)
n.a.	n.a.	4.125 m (13 ft 6 13/32 in)	n.a.	n.a.	n.a.	n.a.
43.0 (462.3)	23.0 (247.3)	23.0 (247.3)	23.0 (247.3)	23.0 (247.3)	23.0 (247.3)	23.0 (247.3)
n.a.	n.a.	5,350 (11,790)	n.a.	5,339 (11,770)	n.a.	n.a.
8,750 (19,290)	8,000 (17,640)	8,200 (18,080)	8,900 (19,620)	8,725 (19,235)	8,000 (17,640)	8,825 (19,425)
2,500 (1,552)	2,175 (1,350)	2,230 (1,385)	2,175 (1,350)	2,175 (1,350)	2,175 (1,350)	2,175 (1,350)
n.a.	8.0 (56,430/17,200)	9.0 (58,070/17,700)	9.8 (55,120/16,800)	8.5 (55,770/17,000)	8.0 (55,120/16,800)	n.a.
n.a.	17,700 (58,070)	18,200 (59,710)	17,300 (56,760)	17,800 (58,400)	17,300 (56,760)	17,300 (56,760)
n.a.	1,210 (751) †	1,300 (807) †	1,300 (807) †	1,210 (751) †	1,460 (906)	1,210 (751) †
n.a.	900 (2,950)	800 (2,620)	950 (3,120)	830 (2,720)	900 (2,950)	n.a.
n.a.	550 (1,800)	550 (1,800)	550 (1,800)	550 (1,800)	550 (1,800)	n.a.
n.a.						
–	1 x A-12.7 ‡	1 x GSh-23	1 x GSh-23	1 x GSh-23	1 x A-12.7 ‡	1 x GSh-23
–	2 x R-3S	2 x R-3S 2 x R-3R	2 x R-3S 2 x R-3R	2 x R-3R 4 x R-60	2 x R-3S	2 x R-27R1 or 2 x R-27T1 4 x R-73E or 4 x R-60M
–						
–	–	2 x 500 (2 x 1,102)	2 x 500 (2 x 1,102)	2 x 500 (2 x 1,102)	–	2 x 500 (2 x 1,102)

Crew escape system: The MiG-21 *sans suffixe*, MiG-21F/MiG-21F-13, MiG-21PF, MiG-21PFS, MiG-21FL and early-production MiG-21PFMs (up to and including Batch 14) are equipped with a Mikoyan SK cartridge-fired ejection seat. The seat pan is dished to take the pilot's parachute. Ejection is accomplished by pulling the face blind down; as the seat fires, the headrest engages two lugs at the rear of the canopy and rotates it, disengaging the hinges at the front so that the seat takes the canopy with it as it leaves the cockpit, the canopy acting as an additional protection against the slipstream for a while. At moderate airspeeds the pilot can elect to use a sequenced ejection in which the canopy is jettisoned separately and the seat fired 0.25 seconds later.

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Specifications of the MiG-21F-13

Powerplant	R11F-300
Thrust, kgp (lbst):	
dry	3,900 (8,600)
reheat	5,750 (12,680)
Empty weight, kg (lb)	4,871 (10,738)
Normal take-off weight in 'clean' configuration, kg (lb):	
c/ns N74210701 through N74210814	7,100 (15,650)
from c/n N74210815 onwards	7,265 (16,020)
Normal take-off weight with drop tank, kg (lb):	
c/ns N74210701 through N74210814	7,570 (16,690)
from c/n N74210815 onwards	7,735 (17,050)
Normal take-off weight with drop tank and two 500-kg (1,102-lb) bombs (c/ns N74210701 through N74210814), kg (lb)	8,386 (18,487)
Wing loading, kg/m² (lb/sq ft):	
normal	310 (63.55)
maximum	366 (75.03)
Maximum speed:	
at full military power	1,300 km/h (807 mph)
in full afterburner	Mach 2.05
Landing speed, km/h (mph)	260-280 (161.5-174)
Service ceiling in level flight with two K-13A AAMs, m (ft)	18,800 (62,335)
Maximum range, km (miles):	
with two AAMs	910 (565)
with two AAMs and drop tank	1,580 (981)
Maximum endurance at 11,000m (36,090 ft):	
on internal fuel	1 hr 37 min
with drop tank	1 hr 56 min
Climb time at full military power/in full afterburner, minutes:	
to 5,000 m (16,400 ft)	3.3/1.5 (3.8*)
to 10,000 m (32,810 ft)	6.6/3.2*
to 13,000 m (42,650 ft)	8.9/n.a.
to 19,000 m (62,335 ft)	14.3/10.9*
Take-off run, m (ft):	
'clean'	750 (2,460)
with two AAMs	910 (2,985)
with two AAMs and drop tank	1,580 (5,180)
Landing run, m (ft)	800-1,500 (2,620-4,920)

* with AAMs

Specifications of the MiG-21PF

Take-off weight, kg (lb):	
normal	7,150-7,745 (15,760-17,075)
maximum	8,250-8,770 (18,190-19,330)
overload configuration	8,550-9,080 (18,850-20,020)
Landing weight, kg (lb):	
'clean'	5,415 (11,938)
with empty drop tank	5,485 (12,092)
Take-off run, m (ft):	
no drop tank (TOW 7,750 kg/17,085 lb)	800-950 (2,620-3,120)
with drop tank (TOW 8,220 kg/18,120 lb)	900-1,000 (2,950-3,280)
Unstick speed, km/h (mph):	
no drop tank (TOW 7,750 kg)	300-320 (186-198)
with drop tank (TOW 8,220 kg)	310-320 (192-198)
Landing run (landing weight 5,800 kg/12,790 lb), m (ft):	
without brake parachute	965-1,275 (3,170-4,180)
with brake parachute	800-900 (2,620-2,950)
Landing speed (landing weight 5,800 kg), km/h (mph):	
without brake parachute	265-290 (164-180)
with brake parachute	265-280 (164-174)
Maximum speed, km/h (mph):	
above 12,500 m (41,010 ft)	2,175 km/h (1,350 mph)
with pylons but no drop tank below 5,000 m (16,400 ft)	1,100 km/h (683 mph)
ditto, at 5,000-12,500 m	1,200 km/h (745 mph)
with pylons and drop tank below 12,000 m (39,370 ft)	1,000 km/h (621 mph)
ditto, above 12,000 m	Mach 1.6
Minimum control speed, km/h (mph)	260-280 (161-174)
Climb time to 10,000 m (32,810 ft), minutes:	
at full military power	6.2
in full afterburner	2.7
Service ceiling, m (ft):	
in level flight	19,000 (62,335)
in a zoom climb	up to 30,000 (98,425)
Acceleration time from Mach 1 to Mach 2, minutes:	
at 12,000 m (39,370 ft)	2
at 15,000 m (49,210 ft)	5
Deceleration time from Mach 2 to Mach 1, seconds:	
at 12,000 m	50
at 14,000 m (45,930 ft)	70
at 16,000 m (52,490 ft)	90
Range at 11,000m (36,090 ft), km (miles):	
on internal fuel	1,600 (993)
with drop tank	1,900 (1,180)
Maximum endurance:	
on internal fuel	2 hrs 01 min
with drop tank	2 hr 27 min

Specifications of the MiG-21S

Fuselage length:	
overall (less air intake centrebody)	12.29 m (40 ft 3⁵⁵⁄₆₄ in)
forward fuselage section	4.35 m (14 ft 3¹⁷⁄₆₄ in)
centre fuselage section (with constant cross-section)	2.63 m (8 ft 7³⁵⁄₆₄ in)
detachable rear fuselage section	5.31 m (17 ft 5 in)
Pitot length (measured from air intake lip)	1.9 m (6 ft 2⁵⁄₆₄ in)
Maximum fuselage diameter (less canopy)	1.242 m (4 ft 0⁴⁹⁄₆₄ in)
Fuselage cross-section area, m² (sq. ft):	
including cockpit canopy	1.413 (15.19)
less cockpit canopy	1.22 (13.13)
Air intake diameter at lip	0.87 m (2 ft 10¼ in)
Centrebody maximum diameter	0.8 m (2 ft 7½ in)
Air intake area (including area occupied by centrebody), m² (sq. ft)	0.595 (6.4)
Forward airbrakes area (total), m² (sq. ft)	0.76 (8.18)
Rear airbrake area, m² (sq. ft)	0.47 (5.06)
Landing gear track	2.79 m (9 ft 1²⁷⁄₃₂ in)

Landing gear wheelbase	4.71 m (15 ft 5⅞ in)
Ground angle of parked aircraft	–0°16'
Angle of attack on landing	13°45'
Wing span	7.154 m (23 ft 5²⁵⁄₃₂ in)
Wing mean aerodynamic chord (MAC)	4.002 m (13 ft 1⅜ in)
Aileron area (total), m² (sq. ft):	
gross	1.18 (12.688)
less aerodynamic balance	0.886 (9.526)
Aileron span (each)	1.21 m (3 ft 11⁴⁵⁄₆₄ in)
Aileron MAC (at 90° to hinge axis)	0.373 m (1 ft 2¹¹⁄₁₆ in)
Specific aileron MAC	24.3% of wing chord
Aileron aerodynamic balance area	24.8% of overall aileron area
Vertical tail area (less ventral fin), m² (sq. ft)	5.3 (57.05)
Vertical tail MAC	3.137 m (10 ft 3½ in)

Vertical tail moment arm (distance	
from 32% wing MAC to vertical tail quarter-chord)	3.891 m (12 ft 9⅜ in)
Rudder area, m² (sq. ft)	0.965 (55.97)
Rudder MAC (at 90° to hinge axis)	0.486 m (1 ft 7⅛ in)
Rudder aerodynamic balance area	26.8% of overall aileron area
Ventral fin area, m² (sq. ft)	0.8 (8.61)
Ventral fin length	3.5 m (11 ft 5³¹⁄₆₄ in)
Horizontal tail area (total), m² (sq. ft):	
gross (including area inside fuselage)	6.69 (72.01)
net (stabilators only)	3.94 (42.41)
Horizontal tail span	7.150 m (23 ft 5½ in)
Horizontal tail MAC:	
gross (including area inside fuselage)	1.938 m (6 ft 4¹³⁄₆₄ in)
net (stabilators only)	1.602 m (5 ft 3³⁄₆₄ in)

MiG-21S (continued)

	With two R-3S AAMs (outer pylons removed)	With four R-3S AAMs
Take-off weight, kg (lb)	8,142 (17,950)	8,376 (18,465)
Landing weight, kg (lb)	5,831 (12,855) *	5,915 (13,040) *
Fuel load, kg (lb)	2,320 (5,110) **	2,320 (5,110) **
CG range, % MAC	27.8-32.6	28.8-33.8
Mach limit †	2.05	2.05
Maximum speed, km/h (mph):		
at high altitude	2,175 (1,351)	2,175 (1,351)
at sea level	1,150 (714)	1,150 (714)
Service ceiling in level flight, m (ft) ‡	18,000 (59,055)	16,800 (55,120)
Climb time from h = 500 m (1,640 ft)		
to service ceiling, minutes	8.5	10.5
Effective range at 10,000m (32,810 ft), km (miles): §		
on internal fuel	1,240 (770)	1,140 (708)
with one drop tank	1,490 (925)	1,380 (857)
with three drop tanks/no AAMs	2,100 (1,304)	–
Maximum endurance at 10,000 m: §		
on internal fuel	1 hr 40 min	1 hr 32 min
with one drop tank	2 hrs 03 min	1 hr 52 min
with three drop tanks/no AAMs	2 hrs 46 min	–
G limit ¶	7	6
Unstick speed, km/h (mph):		
no JATO boosters	320 (198)	325 (201)
with JATO boosters	300 (186)	310 (192)
Take-off run in full afterburner, m (ft):		
no JATO boosters	900 (2,950)	950 (3,120)
with JATO boosters	500 (1,640)	550 (1,800)
Landing speed		
with flap blowing engaged, km/h (mph) •	270 (167)	270 (167)
Landing run (flap setting 45°), m (ft): •		
without brake parachute	950 (3,120)	950 (3,120)
with brake parachute	550 (1,800)	550 (1,800)

* 7% fuel reserves in the main tanks, no missiles
† At altitudes above 12,500 m (41,010 ft)
‡ Attained at Mach 1.8
§ With the drop tank(s) being jettisoned after running dry, 7% fuel reserves in the main tanks, a four-minute allowance for the landing circuit and with the missiles still on the wings.
¶ With 1,400 litres (308 Imp gal) of fuel remaining
• With a 6,500-kg (14,330-lb) landing weight
** Fuel specific gravity 0.83 g/cm³

MiG-21S (continued)

Speed with or without R-3S AAMs:	
at 0-2,000 m (0-6,560 ft)	1,100 km/h (683 mph)
at 2,000-12,500 m (6,560-41,010 ft)	1,200 km/h (745 mph)
above 12,500 m	Mach 2.05
Speed with one or three drop tanks (full or empty); or with one drop tank and AAMs; or with an RN-25 nuclear bomb and two drop tanks:	
at 0-12,500 m (6,560-41,010 ft)	1,000 km/h (621 mph)
above 12,500 m	Mach 1.6
Speed with GP-9 cannon pod and with or without R-3S AAMs:	
at 0-2,000 m (0-6,560 ft)	1,100 km/h (683 mph)
at 2,000-10,800 m (6,560-35,430 ft)	1,200 km/h (745 mph)
above 10,800 m	Mach 1.8
Speed with RN-25 nuclear bomb and with or without R-3S AAMs:	
at 0-12,100 m (6,560-39,700 ft)	1,100 km/h (683 mph)
above 12,100 m	Mach 1.8
Speed with general-purpose bombs and S-24 unguided rockets:	
at 0-8,500 m (6,560-27,890 ft)	1,000 km/h (621 mph)
above 8,500 m	Mach 1.3

The MiG-21S had an indicated airspeed (IAS) range spanning from a minimum control speed of 260 km/h (161 mph) to a never-exceed speed (VNE) of 2,175 km/h (1,351.48 mph). The following table gives the fighter's speed limits (as indicated by the airspeed indicator's broad needle).

The never-exceed speed in level flight is attained in afterburner mode at altitudes between 12,500 and 17,500 m (41,010-57,410 ft). When VNE is achieved, the MiG-21S still has thrust reserves that theoretically allow it to go faster. For example, when doing 2,175 km/h with two AAMs at 13,000 m (42,650 ft) the fighter still has an acceleration of 1.25 m/sec2.

MiG-21*bis*

Fuselage length:	
overall (less air intake centrebody)	12.25 m (40 ft 2⅝ in)
forward fuselage section	4.31 m (14 ft 1⅛ in)
centre fuselage section (with constant cross-section)	2.63 m (8 ft 7³⁵⁄₆₄ in)
detachable rear fuselage section	5.31 m (17 ft 5 in)
Fuselage cross-section area, m² (sq. ft):	
including cockpit canopy	1.413 (15.19)
less cockpit canopy	1.22 (13.13)
Air intake diameter at lip	0.9 m (2 ft 11⅞ in)
Centrebody maximum diameter	0.8 m (2 ft 7½ in)
Air intake area (including area occupied by centrebody), m² (sq. ft)	0.636 (6.85)
Take-off weight, kg (lb):	
with two R-3S AAMs and 2,400 kg (5,290 lb) of fuel	8,700 (19,180)
with two R-3S AAMs and 800-litre (198 Imp gal) drop tank/3,060 kg (6,750 lb) of fuel	9,497 (20,937)
with three 490-litre (107.8 Imp gal) drop tanks/3,600 kg (7,940 lb) of fuel	9,339 (20,588)
Landing weight, kg (lb)	6,750 (14,880) *
Internal fuel load, kg (lb)	2,400 (5,290) †
CG range, % MAC	28.8-32.9
Mach limit	2.05 ‡
Maximum speed, km/h (mph):	
at high altitude	2,175 (1,351) ‡
at sea level	1,300 (807)
Acceleration time at contingency rating, seconds: ¶	
600 to 1,100 km/h (372 to 683 mph)	18.5
1,100 to 1,300 km/h (683 to 807 mph)	14.0
Service ceiling, m (ft)	17,500 (57,410) §
Climb time to service ceiling in full afterburner, minutes	8
Maximum rate of climb at sea level, m/sec (ft/min)	235 (46,250) ¶
Effective range, km (miles): •	
at 10,000 m (32,810 ft), 'clean'	1,290 (801)
at 10,000 m with two R-3S AAMs	1,900 (708)
at 9,000 m (29,530 ft) with two R-3S AAMs and 490-litre (107.8 Imp gal) drop tank	1,370 (851)
at 9,000 m with two R-3S AAMs and 800-litre (176 Imp gal) drop tank	1,430 (888)
at 9,000 m with two R-3S AAMs and two 490-litre drop tanks	1,600 (993)
at 9,000-9,500 m (29,530-31,170 ft) with no missiles and three 490-litre drop tanks	1,900 (1,180)
Maximum endurance: •	
at 10,000 m, 'clean'	1 hr 38 min
at 10,000 m with two R-3S AAMs	1 hr 27 min
at 9,000 m with two R-3S AAMs and 490-litre drop tank	1 hr 47 min
at 9,000 m with two R-3S AAMs and 800-litre drop tank	1 hr 56 min
at 9,000 m with two R-3S AAMs and two 490-litre drop tanks	2 hrs 06 min
at 9,000-9,500 m with no missiles and three 490-litre drop tanks	2 hrs 30 min
G limit	8.5 **
Unstick speed, km/h (mph)	340 (211)
Take-off run in full afterburner, m (ft)	830 (2,720)
Landing speed with BLC engaged, km/h (mph)	270 (167) ††
Landing run with BLC engaged (flap setting 45°), m (ft):	
without brake parachute	1,000 (3,280)
with brake parachute	550 (1,800) ††

Notes:
* 25% fuel remaining, no missiles
† Fuel specific gravity 0.83 g/cm³
‡ At altitudes above 11,300 m (37,070 ft)
§ Attained at Mach 1.85, with 700 litres (154 Imp gal) of fuel remaining at the service ceiling
¶ Acceleration time and rate of climb at sea level are given for an all-up weight of 7,500 kg (16,530 lb)
• With the drop tank(s) being jettisoned after running dry, 7% fuel reserves in the main tanks, a seven-minute allowance for running up the engine and taxiing before take-off, a four-minute allowance for the landing circuit and with the missiles still on the wings.
** Permitted at speeds below Mach 0.8 and less than 900 litres (198 Imp gal) of fuel remaining
†† With a 6,800-kg (14,990-lb) landing weight, a 9° landing angle of attack and the brake parachute being deployed just before touchdown

External stores used by the MiG-21

	R-3S IR-homing AAM	R-3R radar-homing AAM	K-13M IR-homing AAM	R-55 IR-homing AAM	UB-16-57U rocket pod*	S-24 unguided rocket
Quantity	2 (4)*	2 (4)*	2 (4)*	2 ****	2 (4)*	2
Diameter	0.127 m (5 in)	0.127 m (5 in)	0.127 m (5 in)	0.206 m (8⅛ in)	0.33 m (1 ft 1 in)	0.24 m (9⅜ in)
Length	2.83 m (9 ft 3³⁷⁄₆₄ in)	3.35 m (10 ft 11⁵⁷⁄₆₄ in)	n.a.	2.688 m (8 ft 9⁵³⁄₆₄ in)	1.85 m (6 ft 0⁵³⁄₆₄ in)	2.22 m (7 ft 3¹³⁄₃₂ in)
Cross-section area, m² (sq ft)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Unit weight, kg (lb)	n.a.	81 (178)	90 (198)	92 (202)	n.a.	n.a.

* Depending on the fighter's version. ** With sixteen S-5M or S-5K FFARs each

Ferdinand Kasmann

Ferdinand Kasmann

Later single-seat versions feature a Mikoyan KM-1 or KM-1M cartridge-fired ejection seat and a sideways-hinged canopy. The ejection is sequenced so that the seat fires only when the canopy has been jettisoned. The KM-1 may be used throughout the MiG-21's altitude envelope; ejection on the ground is possible at speeds of at least 130 km/h (80.78 mph). The canopy can be jettisoned automatically (that is, pyrotechnically) or manually (that is, mechanically).

The MiG-21U trainer has SK ejection seats. The MiG-21US and MiG-21UM are equipped with a KM-1U seat in the front cockpit (the U stands for *oochenik* – trainee) and a KM-1I seat in the rear cockpit (the I stands for *instrooktor* – instructor). The canopy jettison handles are located on the starboard sill of both cockpits; jettisoning the forward canopy automatically triggers the rear canopy jettison mechanism.

▲
An R-60U fixed acquisition round (outer pylon) and an R-27ER semi-active radar homing AAM under the wing of the MiG-21-93.

An R-77 (RVV-AE) radar-homing AAM carried by a MiG-21*bis* UPG.
▼

A UB-16-57UM rocket pod with long-barrel launch tubes fitted to a MiG-21PF.
▼

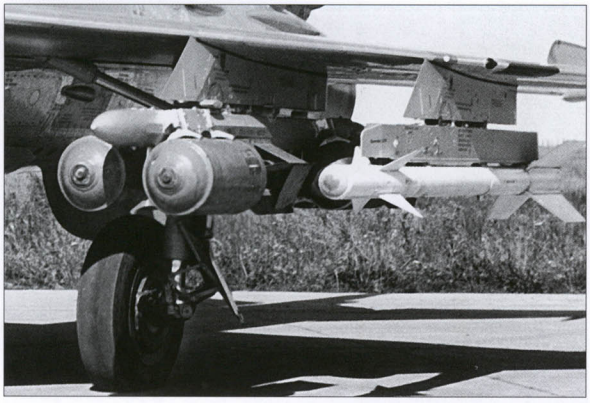
Simon Watson

Ferdinand Kasmann

FAB-100 HE bomb	FAB-250 HE bomb	FAB-500 HE bomb	ZB-62 napalm tank	ZB-360 napalm tank	PTB-490 drop tank	PTB-800 drop tank
2	2	2	2	2	1-3*	1
0.28 m	0.325 m	0.45 m	0.5 m	0.5 m	0.43 m	
(11 in)	(1 ft 0⁵⁄₁₆ in)	(1 ft 5²³⁄₃₂ in)	(1 ft 7¹⁄₁₆ in)	(1 ft 7 11/16 in)	(1 ft 4¹⁵⁄₁₆ in)	
1.044-1.06 m	1.5-1.92 m	1.54-2.43 m	2.7 m	2.616 m	5.218 m	
(3 ft 5⅛ in –	(4 ft 11¾ in –	(5 ft 0⅝ in –	(8 ft 10¹⁵⁄₆₄ in)	(8 ft 7 in)	(17 ft 1⁷⁄₁₆ in)	
3 ft 5⁷⁄₆₄ in) ***	6 ft 3¹⁵⁄₃₂ in) ***	7 ft 11⁴⁵⁄₆₄ in) ***				
n.a.	n.a.	n.a.	n.a.	n.a.	0.145 (1.56)	0.212 (2.28)
125 (275)	276 (608)	525 (1,157)	n.a.	345 (760)	n.a.	

*** The length of the FAB-100, FAB-250 and FAB-500 is also quoted as 1.15 m (3 ft 9⅜ in), 1.5 m (4 ft 11¾ in) and 1.5 m respectively **** MiG-21*bis*

RSK MiG



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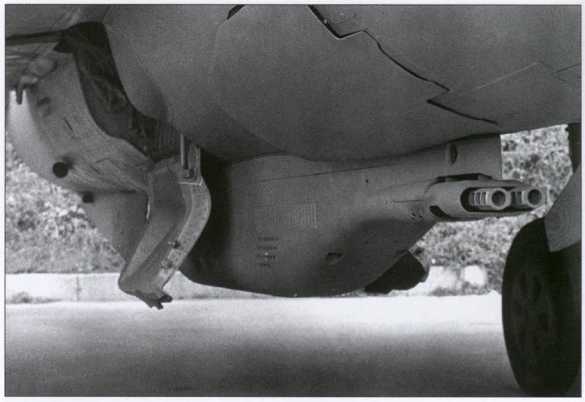
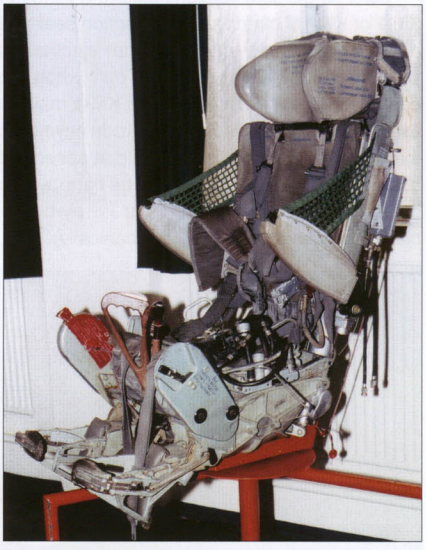


▲ An MBD3-U6-68 multiple ejector rack with FAB-50 bombs and an R-3S AAM under the wing of a MiG-21S.

►▲ A GP-9 cannon pod fitted to a MiG-21PFM.

RSK MiG

▲ The built-in GSh-23L cannon of an early MiG-21SM.



► A KM-1 ejection seat in post-ejection configuration. Note the deployed arm and leg restraints.

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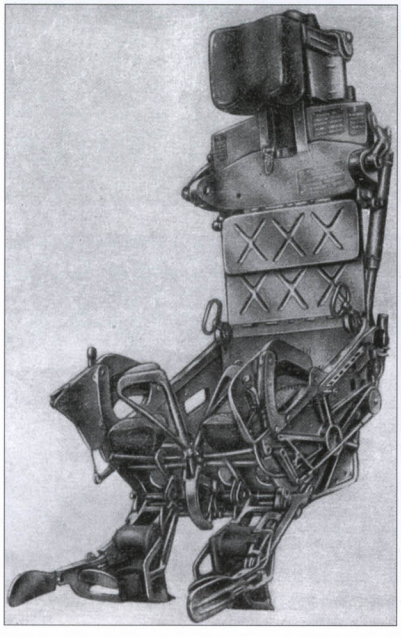
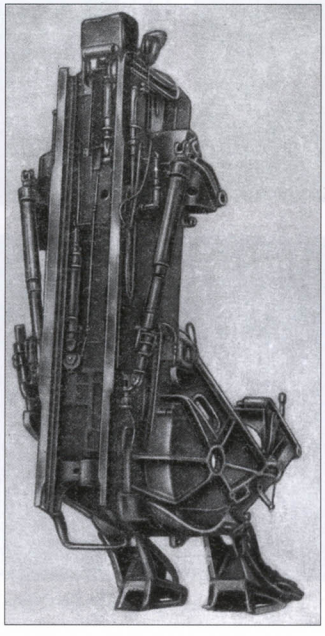
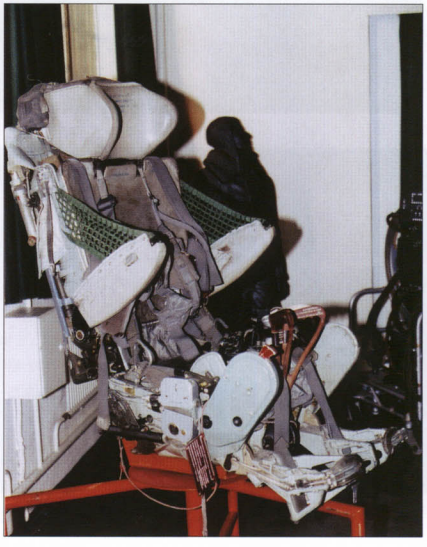
Front and rear views of the SK ejection seat fitted to early versions of the MiG-21. ▼





Yefim Gordon archive



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PART TWELVE

MiG-21 OPERATORS

The Commonwealth of Independent States

On 24th August 1991 the Soviet Union ceased to exist. The military assets located in the former constituent republics were taken over by the members of the newly formed Commonwealth of Independent States (CIS). The MiG-21s operated by the CIS states (excluding Russia) are dealt with below.

Azerbaijan

When the Soviet Air Force flew out after the dissolution of the USSR in 1991 no MiG-21s were left behind. In 1992 the **Azeri Air Force** had 124 combat aircraft and 24 armed helicopters and still no MiG-21s. However, during the border dispute with Armenia about a dozen MiG-21 fighters were acquired – probably from the Ukraine; one was later lost to ground fire over the disputed Nagornyy Karabakh enclave. No c/ns or tactical codes have been noted. Five aircraft are reportedly based at Kyurdamir.

Georgian Air Force MiG-21UM '27 Red' sits unserviceable at Tbilisi-Marneuli in 2004. The faded insignia suggest the aircraft has been in Georgian AF service for quite a while. ▼

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After the recent acquisition of 48 MiG-29s from Belorussia and the Ukraine the Azeri Air Force announced it was standardising on this type and withdrawing its MiG-21 fighters.

Georgia

The Soviet Republic of Georgia became an independent republic in 1992, one year after the dissolution of the USSR. In that year all former Soviet (now Russian) aviation units returned home. The equipment left behind became the property of the new state, which during the civil strife of the 1990s formed the Republic of **Georgian Air Force & Air Defence Force**. No MiG-21 fighters were included in the inventory of the new air arm but the Tbilaviamsheni plant (former plant No. 31) at Tbilisi retained two MiG-21UM trainers. It has been reported that these have been passed on to the Air Force and are being, or have been, refurbished as combat aircraft. One of them, coded '27 Red' and wearing a four-tone green/brown camouflage, was noted with the 44763rd Composite Air Unit at Tbilisi-Marneuli in 2004.

Kyrghyzstan

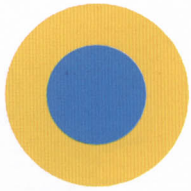
After the dissolution of the USSR in 1991 the now independent Republic of Kyrghyzstan had substantial numbers of MiG-21s in storage on its airfields. In particular, quite a few MiG-21*bis* fighters and MiG-21UM trainers (occasionally with the tactical codes and the Soviet national insignia scrubbed out) are stored at Kant AB not far from Bishkek. The **Kyrghyz Air Force** is not interested in using them and they have been offered for sale on a buyers' market.

Georgian Air Force MiG-21UM (44763rd Composite Air Unit, Tbilisi-Marneuli)

The Ukraine

When the USSR was dissolved and the Ukraine became a sovereign state, it gained possession of all the aircraft on its airfields. The **Ukrainian Air Force** (UAF, or VPS – *Viys'**kov**o-po**vit**ryany **syl**y Ookra**yin**y*) was created on 17th March 1992 but no MiG-21s were incorporated into its regiments. In fact, the UAF had only used a few for training and development but many, one report suggests 83, were still stored out of use on Ukrainian airfields and at repair plants in L'vov and Odessa. These aircraft were offered for sale either in 'as-is' condition or reconditioned; for example, six MiG-21UMs were sold to Vietnam in 1996, five MiG-21Us to India in 1997, a single MiG-21MF to Angola in 2000 and three more

Ukrremont

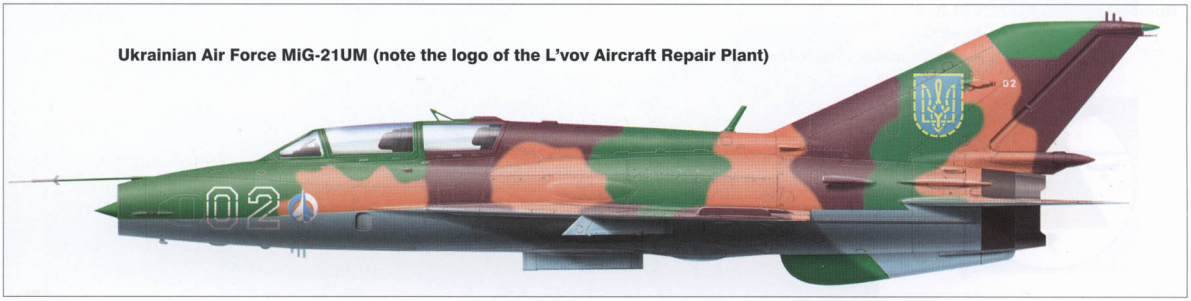


▲
A MiG-21*bis* *Fishbed-L* in current Ukrainian Air Force insignia.

Known Ukrainian Air Force MiG-21s (including out-of-service aircraft in UAF markings)

Tactical code	Version	C/n	Comments
01 Blue	MiG-21*bis*	75041927?	Two-tone green/brown camouflage, old-style insignia, later new-style insignia
01 White outline	MiG-21UM	?	Three-tone green/brown camouflage, new-style insignia. Preserved Lugansk Aviation Museum
01 White outline	MiG-21SM	?	Three-tone green/brown camouflage, new-style insignia
02 White outline	MiG-21UM	?	Three-tone green/brown camouflage, new-style insignia
17 Red outline	M-21 (MiG-21Ye)	?	Silver overall. Converted MiG-21PFM
17 Red	MiG-21*bis*	75021730	Preserved Khar'kov-Lyubotin; reported in error as a MiG-21SMT
21 Red	MiG-21PFM	?	Three-tone green/brown camouflage, new-style insignia. Preserved Ukrainian National Aviation Museum, Kiev-Zhuluany
'21 Blue' No. 1	MiG-21F	?	Silver overall, new-style insignia. Preserved Lugansk Aviation Museum
'21 Blue' No. 2	MiG-21US	?	Silver overall, new-style insignia; avionics testbed? (antenna pods on wing leading edge). Preserved Lugansk Aviation Museum
21 Yellow	MiG-21F-13	N74210313	Preserved Khar'kov-Lyubotin
45 Red outline	M-21 (MiG-21Ye)	940ACh17	Line number 1717. Silver overall, new-style insignia. Converted MiG-21PFM. Preserved Ukrainian National Aviation Museum, falsely marked on placard as "MiG-21PF"
54 Red	MiG-21PFM	?	Silver overall, new-style insignia. Preserved at a UAF base
76 Red	MiG-21UM	?	Stored Ukrainian National Aviation Museum 6-06 in dismantled condition
82 Yellow	MiG-21US	?	Three-tone green/brown camouflage, new-style insignia
135 Red	MiG-21PFM	?	Preserved Khar'kov city

Ukrainian Air Force MiG-21UM (note the logo of the L'vov Aircraft Repair Plant)



MiG-21UMs to India in 2000. As part of an exchange deal involving MiG-29s and cash, the UAF received 25 MiG-21s from Algeria in 2003 in a trade-in arrangement; these were probably scrapped or, if not, sold on. So, although the UAF has never strictly speaking been a MiG-21 operator it has been involved with them commercially.

Since few Ukrainian MiG-21s have been positively identified by c/n, the list on page 455 is in tactical code order.

Non-CIS Operators

Afghanistan

The **Afghan Air Force** (*Afghan Hanai Qurah*) was formed on 22nd August 1924, utilising a few aircraft delivered from the USSR in 1921. It ceased to exist as an effective force in 1929 when its entire equipment was destroyed in a revolution and was not revived until 1937. In 1947 it became the **Royal Afghan Air Force** and retained this title until 1973 when another revolution changed its title to the **Democratic Republic of Afghanistan Air Force** (DRAAF). At this stage, thanks to significant help from the USSR, it grew rapidly and 40 MiG-21F-13 (*izdeliye* 74) fighters arrived in 1973 together with technical help and training supplied by Warsaw Pact pilots and engineers. Concerned about the warring factions within the country and worried about having an unstable Islamic country as a neighbour, in December 1979, at the invitation of the Afghanistan government, the USSR sent an expeditionary force, the so-called 40th Army, in the hope of producing a stable situation. At this stage the DRAAF was reinforced by the arrival of 70 MiG-21MF (*izdeliye* 96F) and 50 MiG-21*bis* (*izdeliye* 75A and *izdeliye* 75B) fighters plus six MiG-21UM (*izdeliye* 69A) trainers.

By the late 1980s there were two, possibly three, regiments equipped with MiG-21s in the DRAAF. The 322nd Fighter Regiment at Bagram had four squadrons, each with 20 aircraft, a mix of MiG-21MFs, MiG-21*bis* and two MiG-21UMs. The 393rd Fighter Regiment at Mazar-e-Sharif had three similarly equipped squadrons; probably some MiG-21PFMs (*izdeliye* 94A) were based here.

The Western nations and Afghanistan's Islamic neighbours were outraged by what they considered to be a Soviet invasion and the extension of communism but initially took no direct military action. However, by the early 1980s the local dissenters (known as the Mujahideen) were encouraged to rebel and supplied with increasingly sophisticated weaponry. Many imams declared a *jihad* or Holy War against the invaders, and volunteers eager to achieve martyrdom and mercenaries looking for spoils crossed the borders – particularly from Pakistan. The delivery via Pakistan of US-built FIM-92 Stinger shoulder-launched SAMs turned the tide in favour of the rebels and in 1989 the USSR pulled out its troops. Some MiG-21s were left behind and taken on charge by the DRAAF. Full details of these acquisitions are not known but may account for reports and photographs of examples of the or MiG-21PFS (*izdeliye* 94A) and MiG-21PFM (*izdeliye* 94A) in DRAAF markings.

Unserviceable MiG-21PFM '72 Red' shows faded DGAF insignia (the red colour has vanished). ▼

via Internet

▶ **Bombed-up MiG-21*bis* '951 Red' in DRAAF insignia.**

via Internet

Democratic Republic of Afghanistan Air Force MiG-21PFM (late)

The pro-Soviet government of Najibullah did not fall immediately due to various factions of the rebels fighting amongst themselves for supremacy. By the end of 1991 desertion and lack of supplies and support from the USSR had reduced the DRAAF to a chaotic state and many of the MiG-21s were at that point in the hands of two local warlords, each having his own 'air force' formed from former DRAAF aircraft and personnel. General Abdul Rashid Dostum's militia, which later evolved into the Northern Alliance, was in possession of about fifty aircraft, including a few MiG-21s and Su-22s. The other faction was the Jamiat-e-Islami Forces of Ahmad Shah Massoud. These private armies joined forces to attack Kabul, which fell on 26th April 1992 .

Subsequently this alliance split up and Dostum was joined by the army of Golboddin Hekmatyar, which had no MiG-21s; the combined air force was known as the **Dostum-Golboddin Air Force** (DGAF).

All these private air forces drew on equipment formerly belonging to the DRAAF, each aircraft being given the warlord's own roundel on the tail. No new MiG-21s were imported. Fortunately there was no attempt to change the tactical codes, only occasionally the new

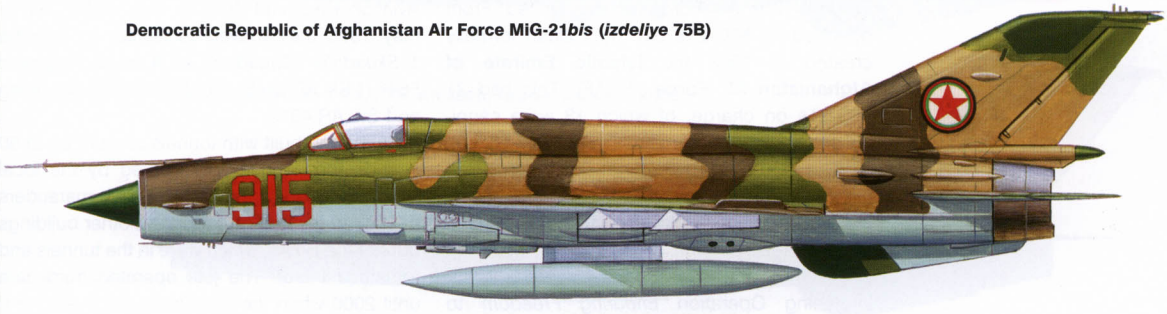
Examples of early MiG-21 variants in Afghan service

Serial	Version	Comments
72 Red	MiG-21PFM	Early model (MiG-21PFS?). DRAAF, DGAF, IEAAF, blue c/s. Derelict Bagram
74 Red	MiG-21PFM	DRAAF
351 Red	MiG-21PFM	DRAAF
352 Red	MiG-21PFM	Late model. DRAAF, silver overall

Known Afghan MiG-21MFs

Serial	Version	Comments
09 Red	MiG-21MF	DRAAF, DGAF, IEAAF, derelict Bagram
313 White	MiG-21MF	DRAAF, DGAF, IEAAF, derelict Bagram
318 White	MiG-21MF	DRAAF, DGAF, IEAAF, derelict Bagram
324	MiG-21MF	DRAAF, noted 1987 at Air Academy
331	MiG-21MF	DRAAF, DGAF, IEAAF, derelict Bagram
352 Red	MiG-21MF	DRAAF, DGAF, IEAAF, derelict Kabul
365 Red	MiG-21MF	DRAAF
375 Red	MiG-21MF	DRAAF, green/brown camouflage. Derelict
376	MiG-21MF	DRAAF
377	MiG-21MF	DRAAF, DGAF, IEAAF, noted 2002 Mazar-e-Sharif
382	MiG-21MF	DRAAF, DGAF, IEAAF, derelict Kabul
527	MiG-21MF	DRAAF, DGAF, IEAAF, derelict Bagram
556	MiG-21MF	DRAAF, noted 2002 Kabul

Democratic Republic of Afghanistan Air Force MiG-21*bis* (*izdeliye* 75B)



Known Afghan MiG-21*bis* fighters		
Serial	**Version**	**Comments**
05 White outline	MiG-21*bis*	Ex Soviet Air Force. DRAAF, derelict Bagram Airport
335 White	MiG-21*bis*	DRAAF, DGAF, IEAAF, derelict Bagram Airport
396 Black	MiG-21*bis*	DRAAF
604	MiG-21*bis*	DRAAF, DGAF, IEAAF, noted 2002 Mazar-e-Sharif
911 White	MiG-21*bis*	DRAAF, DGAF, IEAAF, derelict
915 Red	MiG-21*bis* (*izd.* 75B)	DRAAF
923 White	MiG-21*bis*	DRAAF, DGAF, IEAAF, green/brown/grey camouflage
944	MiG-21*bis*	DRAAF, noted Bagram 1989
947 Red	MiG-21*bis*	DRAAF, derelict Bagram airport
951 Red	MiG-21*bis* (*izd.* 75A)	DRAAF, DGAF, IEAAF, four-tone green/brown camouflage. Derelict Bagram airport
954	MiG-21*bis*	DRAAF
955 Red	MiG-21*bis*	Green/black/tan camouflage. Preserved as gate guard, location unknown, phony style of serial characters
957 Red	MiG-21*bis*	DRAAF, four-tone green/brown camouflage. Preserved Sharea Faisal, Pakistan, in fake black/grey/green camouflage

Known Afghan MiG-21 trainers			
Serial	**Version**	**C/n**	**Comments**
548 White	MiG-21UM	?	Three-tone green/brown camouflage. DRAAF, DGAF, IEAAF, derelict
0549 Red	MiG-21UM	?	DRAAF
561 White	MiG-21UM	?	DRAAF, DGAF, IEAAF, green/brown/tan camouflage
578 Red	MiG-21U (*izd.* 66-400)	661719	DRAAF, DGAF, IEAAF, preserved Kabul city
0588	MiG-21UM	?	DRAAF, DGAF, IEAAF, derelict Bagram airport

operators changed their colour that the DRAAF had originally applied: red for fighters, white for trainers.

Upset by the civil war next door, Pakistan, financially supported by Saudi Arabia, set up the Taliban militia to try and unite the warlords under an Islamic banner – and created a Frankenstein's monster in so doing. This movement began in the south of the country and, thanks to covert help from the Pakistani Army and Air Force, dominated the whole of Afghanistan, with the exception of the Northern provinces where Dostum, with modest support from Tajikistan and Russia, had set up a United Front against the Taliban. The Air Force of the United Front operated no MiG-21s but the Taliban formally created in 1998 the **Islamic Emirate of Afghanistan Air Force** (IEAAF). This had 21 MiG-21s on charge, of which 13 were cannibalised to make the remaining eight operational.

The events of 11th September 2001 changed this situation dramatically. The USA declared war on terrorism, Pakistan and Saudi Arabia dropped their support of the Taliban, while the USA and its allies invaded Afghanistan, launching Operation *Enduring Freedom* to combat the Taliban, which in the meantime had set up close ties with the al-Qaeda terrorist network. Any MiG-21s that were serviceable were soon reduced to scrap.

Albania

The **Albanian Air Force** (*Forcat Ushtarake Ajore Shqipëtarë*) was formed as such on 24th April 1951. Albania joined the Warsaw Pact in May 1955 but broke off relations with the Soviet Union in December 1961, after which no Soviet aircraft were procured. 12 Chengdu F-7A fighters were delivered from China in November 1970. The F-7As were initially based at Rinas AB, Tiranë, with Aviation Regiment 7594 (renumbered Aviation Regiment 4020 in the 1990s), but in May 1976 they moved to Gjadër to become 1 *Skuadrilja* (Squadron) of Aviation Regiment 5646 (1 Sk. AR 5646). Since the 1990s it is known as 1 Sk. AR 4010.

Although built with tunnels to store up to 50 aircraft, the airbase was sacked by the local populace on 12th March 1997. The marauders destroyed the control tower and other buildings but not the F-7As, which were in the tunnels and remained intact. The jets operated from here until 2000 when the base was deactivated and subsequently only used as a storage facility. The

Chris Lofting

◀ **Albanian Air Force F-7A wearing the current-style roundels sit in the storage tunnel at Gjadër AB.**

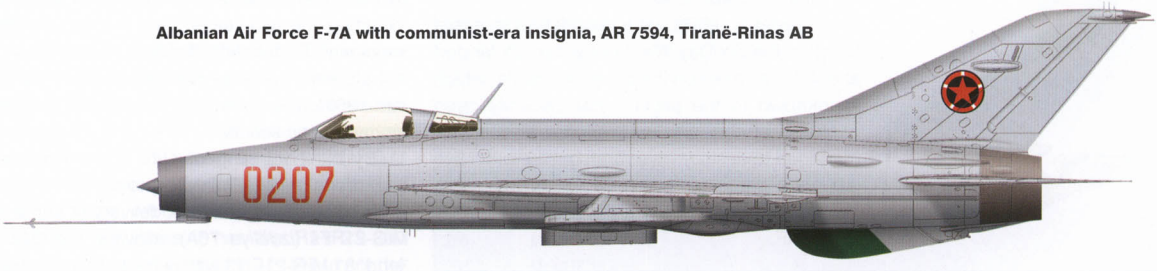
last two F-7As remaining airworthy in 2002 were moved back to Tiranë-Rinas AB to join 2 Sk. AR 4020 where they stayed until withdrawn from service two years later. The F-7As carried red four-digit serials reflecting the last four digits of their construction number. Although built in China they were known locally as the MiG-21F.

Two Albanian F-7As crashed (one in 1974, the other on 29th March 1982).

Algeria

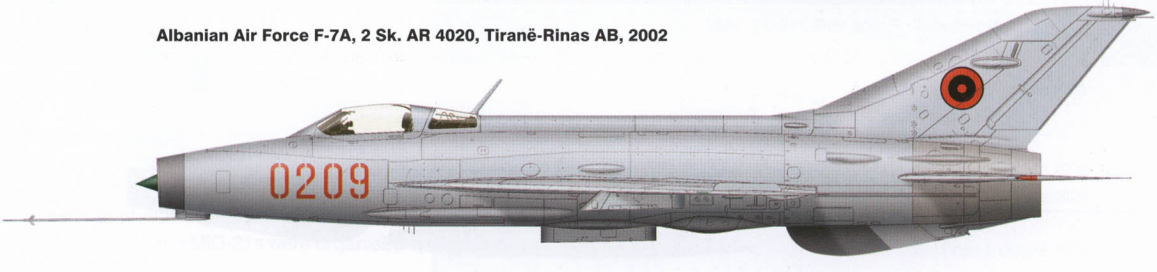
Formed in 1962, shortly after the creation of the new Republic, the **Algerian Air Force** changed its name in 1965 from *Armée de l'Air Algérienne*

Albanian Air Force F-7A with communist-era insignia, AR 7594, Tiranë-Rinas AB



The same aircraft with current insignia in storage at Tiranë-Rinas AB in April 2006

Albanian Air Force F-7A, 2 Sk. AR 4020, Tiranë-Rinas AB, 2002



Albanian Air Force F-7A fleet

Serial	Version	C/n, last four digits	Delivery date	First unit	Comments
0201	Shenyang F-7A	0201	11-1970	AR 7594	1 Sk. AR 5646, from 1990s 1 Sk. AR 4010, from 2000 stored Gjadër
0202	Shenyang F-7A	0202	11-1970	AR 7594	1 Sk. AR 5646, from 1990s 1 Sk. AR 4010, from 2000 stored Gjadër
0203	Shenyang F-7A	0203	11-1970	AR 7594	1 Sk. AR 5646, from 1990s 1 Sk. AR 4010, from 2000 stored Gjadër
0204	Shenyang F-7A	0204	11-1970	AR 7594	1 Sk. AR 5646, from 1990s 1 Sk. AR 4010, from 2000 stored Gjadër
0205	Shenyang F-7A	0205	11-1970	AR 7594	1 Sk. AR 5646, from 1990s 1 Sk. AR 4010, from 2000 stored Gjadër
0206	Shenyang F-7A	0206	11-1970	AR 7594	1 Sk. AR 5646, from 1990s 1 Sk. AR 4010, from 2000 stored Gjadër
0207	Shenyang F-7A	0207	11-1970	AR 7594	1 Sk. AR 4010, 2000 to 2 Sk. AR 4020, from 2004 stored Tiranë-Rinas AB
0208	Shenyang F-7A	0208	11-1970	AR 7594	crashed
0209	Shenyang F-7A	0209	11-1970	AR 7594	1 Sk. AR 4010, 2000 to 2 Sk. AR 4020, from 2004 stored Tiranë-Rinas AB
0210	Shenyang F-7A	0210	11-1970	AR 7594	1 Sk. AR 5646, from 1990s 1 Sk. AR 4010, from 2000 stored Gjadër
0211	Shenyang F-7A	0211	11-1970	AR 7594	
0212	Shenyang F-7A	0212	11-1970	AR 7594	
0304	Shenyang F-7A	?		AR 7594	As only 12 were delivered either 0211 or 0212 was renumbered 0304, the other crashed, 0304 was noted stored Gjadër 2005

to *al Quwwat al Jawwiya al Jaza'eriya* (QJJ). Its first aircraft were a gift from Libya, but the USSR rapidly became its main source of new machines. The first six MiG-21F-13s (*izdeliye* 74) were delivered in 1965; others followed, bringing the total up to about 40.

31 Algerian MiGs were dispatched to assist Egypt in the Six-Day War but the first six landed at el'Arîsh airbase on the Sinai Peninsula, which – unknown to the pilots – had recently been captured by the Israelis. The pilot of one MiG managed to destroy his aircraft but the other five jets were captured intact. Of these, four were sent to America where they were evaluated by the USAF.

QJJ serials initially comprised two digits, and then changed to three digits starting with 2; interestingly, the serials were European-style, not Arabic. In the 1980s the Algerians introduced a new serial system with two letters followed by two or three digits. In the case of all MiG-21s, including the two-seaters, the first letter of the serial was F (denoting 'fighter') . Since most, if not all, early MiG-21s had been retired by the mid-1980s it is doubtful if any carried the new alphanumeric serials.

By the beginning of 1967 there were two squadrons of MiG-21 interceptors.

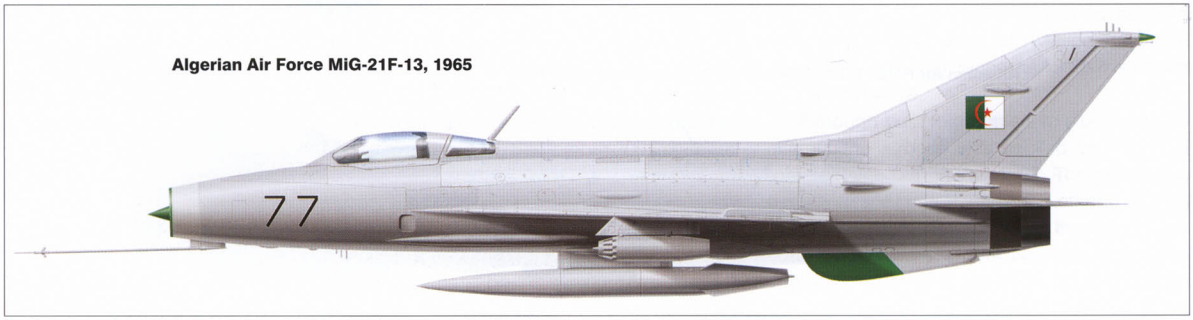
In 1966-67 Algeria took delivery of some 30 MiG-21PFs (*izdeliye* 76A), allowing the QJJ to 'lend' 31 MiG-21F-13 with pilots to Egypt in 1967 to help in the Six-Day War against Israel. Very few were returned to Algeria.

Deliveries of MiG-21PFM (*izdeliye* 94A) fighters followed shortly after but the exact

via Internet

◄ **MiG-21F-13s from the first shipment delivered to the Algerian Air Force. The fighters are equipped with UB-16-57 rocket pods. At that time the national insignia was carried on the fin.**

Algerian Air Force MiG-21F-13, 1965



number is a matter of conjecture as the official QJJ figures quoting total numbers of MiG-21 variants delivered, cite 110 for the 'MiG-21F-13', apparently including the MiG-21PF and MiG-21PFM variants in this total. According to this hypothesis about 40 MiG-21PFMs were received.

Algerian MiG-21PFMs were reported to have served with:

- 11e *Escadron de Chasse* (EdeCh – 11th Fighter Squadron), Colomb, at Béchar-Oukda;
- 140e EdeCh at Ouargla;
- 153e EdeCh at Bou Sfer;
- 630e EdeCh at Bou Sfer;
- 14e EdeCh at Tindouf (as more modern variants arrived the unit's MiG-21PFMs were mixed with MiG-21MFs);
- 19e Colomb at Béchar-Oukda, also a mixed squadron;
- 120e EdeCh at Aïn Oussera (a mixed reconnaissance squadron?).

Six MiG-21Rs (*izdeliye* 94RA) were purchased in the 1970s for tactical reconnaissance but no further details have been released. However, they were in all probability based at Aïn Oussera.

It is plausible that both the MiG-21M (*izdeliye* 96) and the MiG-21MF (*izdeliye* 96F) were delivered, although both versions were known locally as the MiG-21MF. This deduction derives from information published on the official QJJ website which quotes the 'MiG-21MF' as having an RP-22 radar, which was indeed fitted to the MiG-21MF, but states it has the R11F2S-300 engine, which powered the MiG-21M but not the MiG-21MF. It is believed about 60 MiG-21Ms and MiG-21MFs were procured.

The last fighter variant was the MiG-21*bis* (*izdeliye* 75A and 75B), of which about 60 were delivered in the second half of the 1970s. This variant was more effective than earlier models in ground attack. EdeCh 110, 140 and 190 were entirely equipped with the MiG-21*bis*, while EdeCh 630 was a squadron which also had MiG-21MFs. MiG-21*bis* serials under the 1980s system were prefixed FA (see table on p. 462).

Before 1993, the *Escadrons* reported directly to the Headquarters of the Algerian Air Force but thereafter 3e *Escadre de Défense Aérienne* (Air Defence Wing) was formed as a controlling unit. Attrition and obsolescence had significantly reduced the numbers of operational MiG-21 fighters and the procurement of 120 modern MiG-21MF and MiG-21*bis* aircraft allowed a similar number of older variants to be replaced. Subsequently surviving MiG-21s were organised within four *Escadrons de Chasse*:

Algerian Air Force MiG-21F-13s

Serial	Version	C/n	First unit	Comments
66	MiG-21F-13	?		Silver overall
69	MiG-21F-13	?		Silver overall
75	MiG-21F-13	?		Silver overall
77	MiG-21F-13	?		Silver overall
87	MiG-21F-13	?		Silver overall
231	MiG-21F-13	?		
232	MiG-21F-13	?		
233	MiG-21F-13	?		
234	MiG-21F-13	?		
235	MiG-21F-13	?		
236	MiG-21F-13	?		
237	MiG-21F-13	?		
238	MiG-21F-13	?		
239	MiG-21F-13	?		
240	MiG-21F-13	?		
241	MiG-21F-13	?		
242	MiG-21F-13	?		
243	MiG-21F-13	?		
244	MiG-21F-13	?		
245	MiG-21F-13	?		
246	MiG-21F-13	?		
247	MiG-21F-13	?		
248	MiG-21F-13	?		
249	MiG-21F-13	?		
250	MiG-21F-13	?		
251	MiG-21F-13	?		
252	MiG-21F-13	?		
253	MiG-21F-13	?		
254	MiG-21F-13	?		
255	MiG-21F-13	?		
256	MiG-21F-13	?		
257	MiG-21F-13	?		
259	MiG-21F-13	?		
259	MiG-21F-13	?		
260	MiG-21F-13	?		
261	MiG-21F-13	?		
272	MiG-21F-13	?	190e EdeCh?	Noted as ground instructional airframe at Biskra
280	MiG-21F-13	742316	190e EdeCh?	Noted on the dump at Tangiers Airport
1395	MiG-21F-13	?	190e EdeCh?	Noted 1984 withdrawn from use

Known Algerian Air Force MiG-21MFs

Serial	Version	C/n	Comments
?	MiG-21MF	4702	Noted stored Odessa, Ukraine, 2005
'FD'	?	?	Gate guard at Bou Sfer
FD-16	MiG-21MF	4712	Withdrawn from use
FD-19	MiG-21MF	?	Noted stored Odessa, Ukraine, 2005
FD-26	MiG-21MF	3811	Noted stored Odessa, Ukraine, 2005
FD-43	MiG-21MF	?	Photo exists
FD-59	MiG-21MF	?	Noted stored Odessa, Ukraine, 2005

Known Algerian Air Force MiG-21*bis* fighters

Serial	Version	C/n	Comments
?	MiG-21*bis*	75037857?	Noted withdrawn from use
132	MiG-21*bis*	75037821	Noted 1984 withdrawn from use
142	MiG-21*bis*	?	Noted 1984 withdrawn from use
162	MiG-21*bis*	?	Noted 1984 withdrawn from use
171	MiG-21*bis*	?	Noted 1984 withdrawn from use
191	MiG-21*bis*	?	Noted 1984 withdrawn from use
FA-41	MiG-21*bis*	?	Tan/brown camouflage. Noted stored 2005 Odessa, Ukraine
FA-51	MiG-21*bis*	?	Noted stored Odessa, Ukraine, 2005
FA-52	MiG-21*bis*	75036401	Noted 1984 withdrawn from use
FA-62	MiG-21*bis*	75036316	Noted withdrawn from use
FA-63	MiG-21*bis*	?	Noted stored Odessa, Ukraine, 2005
FA-65	MiG-21*bis* (*izd.* 75B)	?	Tan/brown camouflage. Noted stored Odessa, Ukraine, 2005
FA-73	MiG-21*bis*	?	Tan/brown camouflage. Noted stored Odessa, Ukraine, 2005
FA-74	MiG-21*bis*	?	Tan/brown camouflage. Noted stored Odessa, Ukraine, 2005
FA-89	MiG-21*bis* (*izd.* 75A)	?	Tan/brown camouflage. Noted stored Odessa, Ukraine, 2005
FA-92	MiG-21*bis*	75038399	Noted 1984 withdrawn from use
FA-94	MiG-21*bis*	75038210	
FA-96	MiG-21*bis* (*izd.* 75A)	?	Tan/brown camouflage. Noted stored Odessa, Ukraine, 2005

Non-airworthy ex-Algerian Air Force MiG-21MF FD-19 sits at the Odessa military aircraft repair plant, awaiting refurbishment and resale (a sticker below the cockpit reard 'Export'). Note that the Algerian roundels on the rear fuselage have been painted out. ▼

Sergey Burdin

Known Algerian Air Force MiG-21 trainers

Serial	Version	Comments
209	MiG-21UM	Noted withdrawn from use 1984
231	MiG-21UM	Noted withdrawn from use
272	MiG-21UM	Noted withdrawn from use
273	MiG-21UM	Noted withdrawn from use
274	MiG-21UM	Noted withdrawn from use
275	MiG-21UM	Noted withdrawn from use
276	MiG-21UM	Noted withdrawn from use
277	MiG-21UM	Noted withdrawn from use
278	MiG-21UM	Noted withdrawn from use
279	MiG-21UM	Crashed 9-1982
280	MiG-21UM	Noted withdrawn from use
281	MiG-21UM	Noted withdrawn from use
282	MiG-21UM	Noted withdrawn from use
283	MiG-21UM	Noted withdrawn from use
FE-05	MiG-21UM	Tan/brown camouflage
FE-40	MiG-21UM	Tan/brown camouflage
FE-209	MiG-21UM	Noted withdrawn from use 1984, see 209 above

- 113e EdeCh, Tindouf;
- 143e EdeCh, Ouargla;
- 153e EdeCh, Béchar-Oukda;
- 193e EdeCh, Bou Sfer.

In 1997 the QJJ purchased 36 MiG-29S fighters from the Ukraine, trading-in surplus MiG-21MF and MiG-21*bis* types as part of the deal. Similar deals may have been struck with Belarus from whom another 36 MiG-29Ss were acquired.

Very little information is available on the two-seat trainer variants, apart from the fact that the total number delivered is reported as being in the region of 30. Sightings or photographs are listed in the table and from the 1980s the trainers' serials were prefixed FE but it is unlikely that the same numbers were retained.

The last MiG-21 fighters and trainers were finally retired in 2003, having been steadily replaced by more modern types since 1997.

Angola

Until November 1975 Angola was a Portuguese colony and on 21st January 1976 the Republic of Angola was created. Shortly afterwards the **Angolan People's Air Force/Air Defence Force** (FAPA-DAA – *Força Aérea Popular de Angola – Defesa Anti-Aviões*) was formed, utilising aircraft left behind when the Portuguese forces left. Peace, however, did not reign for long, the three separate insurgent groups that had fought for independence from Portugal swiftly engaging in a struggle for control of the country. These were the National Front for the

via Internet

◄ **Algerian Air Force MiG-21*bis* fighters sit in storage beside an Algerian Mil' Mi-8 helicopter at Odessa. FA-65 is a *Fishbed-N*, while FA-89 and FA-96 are *Fishbed-Ls*.**

Liberation of Angola (FNLA – *Frente Nacional por la Libertação de Angola*), the Popular Movement for the Liberation of Angola (MPLA – *Movimento Popular por la Libertação de Angola*) and the National Union for the Total Independence of Angola (UNITA – *União Nacional por la Independencia Total de Angola*). UNITA had split off FNLA in March 1966 when Dr. Jonas Savimbi left it to establish his own group. As time passed this became a straight fight between the FNLA Marxist government, supported by the USSR and its allies (notably Cuba) on one side and UNITA backed by South Africa and the Western Powers on the other. Help from Cuba was on a large scale, with thousands of volunteers joining the army, as well as manning fighter regiments equipped with ex-Cuban Air Force aircraft. This help, as well as that from the USSR, stopped in 1988-89; so did the involvement of the South African Defence Force in the early 1990s but the bitter civil war continued, with sporadic ceasefires, until the death of Jonas Savimbi on 22nd February 2002. In 2003, UNITA took the political path and gave up the armed struggle.

The first MiG-21s to arrive in Angola comprised a squadron of 12 MiG-21MF (*izdeliye* 96F) fighters from the Cuban Air Force with their pilots who flew in on 8th January 1976 (some sources say the fighters arrived in July 1976, retaining the Cuban serials '510 Red' through '521 Red' and the overall silver finish). The first batch of MiG-21MFs to wear Angolan markings was flown in by Soviet Air Force Antonov An-22 airlifters and reassembled on 13th March 1976; these aircraft were serialled C41 through C52. A few months later the USSR sent eight MiG-21F-13 (*izdeliye* 74) fighters and two MiG-21US (*izdeliye* 68A) trainers together with VVS pilots and a support staff of volunteers. In 1980, 12 more MiG-21MFs and at least two MiG-21USs, or MiG-21U (*izdeliye* 66-600), arrived from the USSR to reinforce the FAPA-DAA, followed in

Angolan Air Force MiG-21bis C340 was delivered to Namibia by a defecting FAPA pilot. It is now on display in the South African Air Force Museum. ▼

Chris Lofting

Known Angolan Air Force MiG-21MFs

Serial	Version	Comments
C10	MiG-21MF	
C11	MiG-21MF	
C12	MiG-21MF	
C15	MiG-21MF	
C16	MiG-21MF	Crashed 19-12-1986
C17	MiG-21MF	
C20	MiG-21MF	
C30	MiG-21MF	Crashed 22-9-1986
C32	MiG-21MF	
C35	MiG-21MF	
C40	MiG-21MF	
C41	MiG-21MF	Early insignia. Damaged 16-3-1976
C42	MiG-21MF	Crashed 12-12-1987
C43	MiG-21MF	
C44	MiG-21MF	
C45	MiG-21MF	
C46	MiG-21MF	Damaged beyond repair 25-11-1987
C47	MiG-21MF	
C48	MiG-21MF	Written off after landing accident 1976
C49	MiG-21MF	
C50	MiG-21MF	Reported damaged Lubango 20-11-1983 (some sources say Luena 20-10-1983)
C51	MiG-21MF	Crashed 29-12-1986
C52	MiG-21MF	Crashed 13-8-1988
C53	MiG-21MF	Noted as a wreck Luanda Airport 2001
C54	MiG-21MF	Shot down from ground 20-8-1986
C55	MiG-21MF	
C56	MiG-21MF	
C61	MiG-21MF	
C62	MiG-21MF	
C63	MiG-21MF	Shot down 21-11-1990
C64	MiG-21MF	
C88	MiG-21MF	
C118	MiG-21MF	
C130	MiG-21MF	
C205	MiG-21MF	
C206	MiG-21MF	
C208	MiG-21MF	Crashed 19-8-1986
C209	MiG-21MF	Shot down 29-5-1989
C211	MiG-21MF	Crashed 4-8-1989
C212	MiG-21MF	Crashed 21-8-1991
C213	MiG-21MF	
C214	MiG-21MF	
C215	MiG-21MF	
C216	MiG-21MF	
C217	MiG-21MF	
C218	MiG-21MF	Crashed 5-7-1988
C219	MiG-21MF	Shot down 24-7-1991
C224	MiG-21MF	
C228	MiG-21MF	
C232	MiG-21MF	
C234	MiG-21MF	
C239	MiG-21MF	
C241	MiG-21MF	
C250	MiG-21MF	
C272	MiG-21MF	Shot down 10-11-2002

Known Angolan Air Force MiG-21*bis* fighters

Serial	Version	C/n	Comments
C302	MiG-21*bis*	?	Crashed 5-2-1990
C303	MiG-21*bis*	?	
C304	MiG-21*bis*	?	
C305	MiG-21*bis*	?	Crashed 19-8-1987
C306	MiG-21*bis*	?	
C307	MiG-21*bis*	?	Crashed 7-4-1988
C308	MiG-21*bis*	?	
C309	MiG-21*bis*	?	
C310	MiG-21*bis*	?	Crashed 22-6-1987
C311	MiG-21*bis*	?	Shot down 18-3-1991
C312	MiG-21*bis*	?	Crashed 11-11-1987
C313	MiG-21*bis*	?	
C314	MiG-21*bis*	?	Chocolate brown/dark green/yellow camouflage
C315	MiG-21*bis*	?	
C316	MiG-21*bis*	?	Crashed 26-12-1987
C317	MiG-21*bis*	?	
C318	MiG-21*bis*	?	
C319	MiG-21*bis*	?	
C320	MiG-21*bis*	?	
C321	MiG-21*bis*	?	Crashed 12-8-1985
C322	MiG-21*bis*	?	
C323	MiG-21*bis*	?	Reported written off – date not recorded
C324	MiG-21*bis*	?	
C325	MiG-21*bis*	?	Crashed 19-9-1989
C326	MiG-21*bis*	?	Crashed 24-9-1984
C328	MiG-21*bis*	?	
C328	MiG-21*bis*	?	
C329	MiG-21*bis*	?	Crashed 15-3-1987
C330	MiG-21*bis*	?	Crashed 2-9-1987
C331	MiG-21*bis*	?	Crashed 26-12-1987
C332	MiG-21*bis*	?	
C333	MiG-21*bis*	?	
C334	MiG-21*bis*	?	
C337	MiG-21*bis*	?	
C339	MiG-21*bis*	?	
C340	MiG-21*bis* (*izd.* 75B)	75096900	Tan/green camouflage. Pilot defected to Namibia 1989; pres. SAAF Museum, Swartkop; c/n also rep. as 75091800
C341	MiG-21*bis*	?	Crashed 27-12-1987
C342	MiG-21*bis*	?	
C343	MiG-21*bis*	?	Crashed 27-12-1987
C344	MiG-21*bis*	?	
C345	MiG-21*bis*	?	
C346	MiG-21*bis*	?	
C347	MiG-21*bis*	?	Crashed 22-6-1985
C348	MiG-21*bis*	?	
C349	MiG-21*bis*	?	
C350	MiG-21*bis* (*izd.* 75B)	?	Tan/green camouflage. Derelict
C351	MiG-21*bis*	?	
C355	MiG-21*bis*	?	
C359	MiG-21*bis*	?	Crashed 8-1-1989
C360	MiG-21*bis*	?	
C361	MiG-21*bis*	?	Crashed 14-3-1988
C362	MiG-21*bis*	?	

1983 by a further two to four MiG-21USs and 12 MiG-21*bis* (*izdeliye* 75B) fighters. Further supplies of up to 35 MiG-21*bis* came in 1985, followed by another tranche in 1986 – including, no doubt, more MiG-21UMs. Unfortunately accurate figures of the number of MiG-21s procured by the FAPA-DAA are not available.

Serials were prefixed C for [*aviõe de*] *caça* (fighter) and I for [*aviõe de*] *instruçao* (trainer) as appropriate. To confuse matters, a serial was sometimes used more than once, particularly between 1980 and 1990 when attrition was running at about 20% per year. Worse still, many MiG-21s did not carry their c/ns visibly. It is worth noting that in a war situation, particularly a civil war, priority is given to getting aircraft into action as swiftly as possible – and, if practicable, to confusing the enemy in the process. Unfortunately, the idea of making things easy for future historians was not given precedence.

The FAPA-DAA structure for MiG-21 squadrons up to 1993 when the FAPA-DAA became the autonomous *Força Aérea Nacional* (Air Force, FAN) is as follows:

- 24th AIR (Air Instructional Regiment);
- 9th FTS (Fighter Training Squadron) with seven MiG-21USs and five MiG-21UMs (the proportion of each subtype is approximate);
- 25th ACFR (Air Combat Fighter Regiment);
- 11th FS with a mix of MiG-21F-13s, MiG-21MFs and MiG-21*bis* at various times for reconnaissance and army close support
- 12th FS with MiG-21MFs and or MiG-21*bis* until replaced by MiG-23ML in 1987
- 13th FS with MiG-21MF and or MiG-21*bis* until replaced by MiG-23ML in 1987 for interception;
- 26th ACFR close support regiment (the regiments below did not have MiG-21 types after 1988 but may have done so before that date);
- 14th FS;
- 15th FS;
- 16th FS.

At first MiG-21s and later fighters were flown not by Angolans but by Soviet, Cuban and East European volunteers and mercenaries. For example, the MiG-21F-13s were Soviet manned while the MiG-21MF and MiG-21*bis* squadrons had Cuban pilots and several of these units operated autonomously outside the direct control of the FAPA-DAA. Slowly but surely Angolan pilots were trained and gained sufficient experience to man the MiG-21 squadrons after the departure of the Soviets and Cubans in 1989. Known MiG-21 bases are Moçamedes, Luena, Lubango, Menongue and Cuito Cuanavale.

C363	MiG-21*bis*	?	Crashed 31-1-1987
C364	MiG-21*bis*	?	
C365	MiG-21*bis*	?	Crashed 30-1-1989
C366	MiG-21*bis*	?	Reported written off – date not recorded
C367	MiG-21*bis*	?	
C368	MiG-21*bis*	?	Crashed 13-9-1989
C369	MiG-21*bis*	?	
C370	MiG-21*bis*	?	Crashed 4-3-1991
C371	MiG-21*bis*	?	
C372	MiG-21*bis*	?	
C373	MiG-21*bis*	?	
C374	MiG-21*bis*	?	Crashed 16-2-1991
C375	MiG-21*bis*	?	Crashed 7-3-1988
C376	MiG-21*bis*	?	
C377	MiG-21*bis*	?	
C378	MiG-21*bis*	?	Crashed 26-6-1994
C379	MiG-21*bis*	?	
C380	MiG-21*bis*	?	Crashed 9-7-1988
C381	MiG-21*bis*	?	
C382	MiG-21*bis*	?	
C384	MiG-21*bis*	?	
C387	MiG-21*bis*	?	
C389	MiG-21*bis*	?	
C392	MiG-21*bis*	?	Crashed 13-12-1986
C395	MiG-21*bis*	?	
C396	MiG-21*bis*	?	

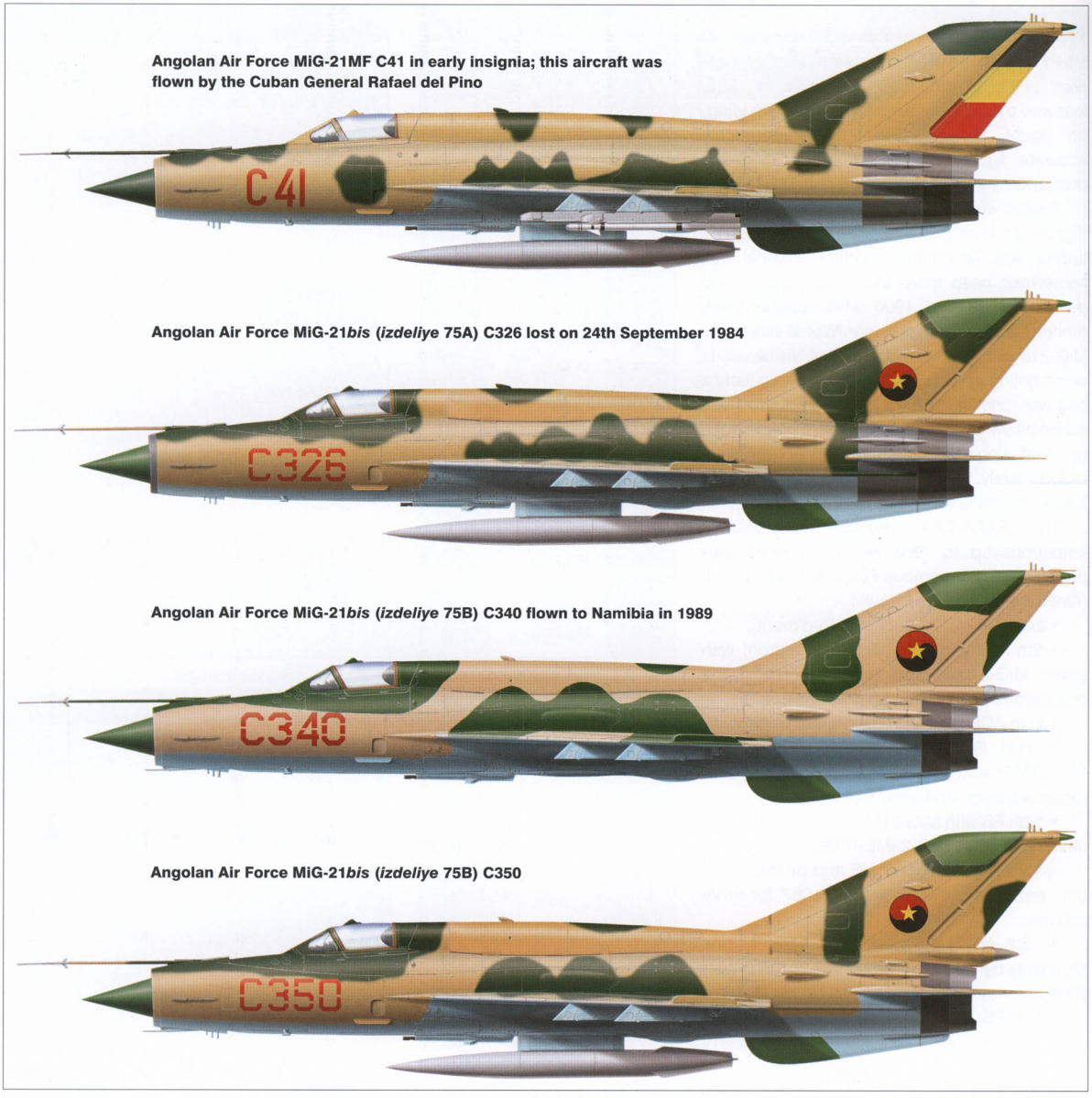
Known Angolan Air Force MiG-21UM trainers

Serial	Version	Comments
I-10	MiG-21UM	Crashed 30-7-1987
I-11	MiG-21UM	
I-12	MiG-21UM	
I-13	MiG-21UM	
I-14	MiG-21UM	Crashed 19-8-1985
I-15	MiG-21UM	
I-16	MiG-21UM	
I-17	MiG-21UM	
I-18	MiG-21UM	
I-19	MiG-21UM	

Since 1998 the order of battle of the FAN included only one fighter/fighter-bomber regiment and by 2007 contained no operational MiG-21s, although there are most likely some airframes in various stages of decomposition lying around on airfields. There have been reports of 18 MiG-21*bis* and four MiG-21UMs nominally on the unit's establishment.

No MiG-21F-13s operated by the Soviet squadron in Angola have been identified yet.

The following aircraft are either MiG-21MFs or MiG-21*bis*: C281, C285, C289, C300 and C301


Angolan Air Force MiG-21MF C41 in early insignia; this aircraft was flown by the Cuban General Rafael del Pino
C41
Angolan Air Force MiG-21bis (izdeliye 75A) C326 lost on 24th September 1984
C326
Angolan Air Force MiG-21bis (izdeliye 75B) C340 flown to Namibia in 1989
C340
Angolan Air Force MiG-21bis (izdeliye 75B) C350
C350

Bangladesh

When the British left India in 1947 the country was subsequently split into two independent republics, India and Pakistan. The latter was in two parts, with India separating them. East Pakistan announced its independence on 26th March 1971 as the People's Republic of Bangladesh and on 16th December 1971, after a brief war between India and Pakistan, Bangladesh was formally allowed to continue its existence.

The **Bangladesh Air Force** (BAF, or BBB – *Bangladesh Biman Bahini*) was formed on 28th September 1971, using at first aircraft donated by the Indian Air Force, but after the war it acquired five F-86As left behind by the Pakistani Air Force. All combat aircraft, except those of 25 Squadron acting as an OCU, are based at Bashar Air Base at Dhaka-Kurmitola.

In 1973 twelve MiG-21MF (*izdeliye* 96F) fighters were delivered but 16 different serials have been reported, indicating further deliveries

Bangladesh Air Force MiG-21M/MFs

Serial	Version	C/n	Delivery date	Unit	Comments
7005	MiG-21M (type 88)	?			
7006	MiG-21M (type 88)	?		5 Sqn	Preserved BBB Museum, Bashar AB
7007	MiG-21M (type 88)	?			Gate guard at Jahangir Gate, Dhaka Airport
7008	MiG-21M (type 88)	?			
7009	MiG-21M (type 88)	?			Preserved at BBB HQ, Dhaka Airport
7012	MiG-21M (type 88)	?			
7201	MiG-21MF (*izd.* 96F)	967201	1973	5 Sqn	
7202	MiG-21MF (*izd.* 96F)	967202	1973		
7203	MiG-21MF (*izd.* 96F)	967203	1973		
7204	MiG-21MF (*izd.* 96F)	967204	1973		
7205	MiG-21MF (*izd.* 96F)	967205	1973		
7206	MiG-21MF (*izd.* 96F)	967206	1973	5 Sqn	
7207	MiG-21MF (*izd.* 96F)	967207	1973		Crashed 1982
7208	MiG-21MF (*izd.* 96F)	967208	1973	5 Sqn	
7209	MiG-21MF (*izd.* 96F)	967209	1973		
7210	MiG-21MF (*izd.* 96F)	967210	1973		

– or, more likely, that existing aircraft were renumbered. The BBB withdrew the type in the 1990s.

Note: The MiG-21Ms listed here are licence-built aircraft manufactured in India; therefore an *izdeliye* designation is not applicable.

Two MiG-21UMs (*izdeliye* 69A) serialled 036 and 046 (c/ns 5169...036 and 5169...046 respectively) also arrived in 1973. The former aircraft is now in storage at the BBB Museum, Bashar AB.

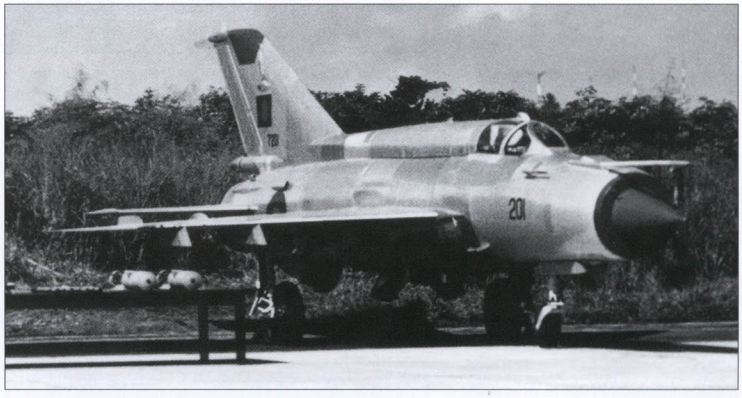
19 Chengdu F-7MB Airguard fighters were delivered in 1989-1990. 5 'Supersonics' and 35 'Thundercats' Squadrons pool their aircraft.

Serials are painted in full on the tailfin but only the last three digits are on the nose:

Four Guizhou FT-7B trainers were delivered in 1990, three more followed in 1998, another in 2000 and three more later:

In 2005 the BBB ordered 12 Chengdu F-7BG fighters, a version of the F-7MG able to carry reconnaissance pods. The first delivery of seven aircraft was on 29th March 2006; known examples are listed on page 468.

Also ordered in 2005 were four Guizhou FT-7BG trainers. Two aircraft serialled 944 and 945 have been identified so far; the latter machine was likewise delivered on 29th March 2006 and is operated by 5/35 Sqns.



via Internet

▲ **7201, the first MiG-21MF delivered to the Bangladesh Air Force.**

Bangladesh Air Force HAL-built MiG-21M 7008

Known Bangladesh Air Force F-7MBs				
Serial	Version	Delivery date	Unit	Comments
1410?	Chengdu F-7MB	1989-1990	5/35 Sqns	
1411?	Chengdu F-7MB	1989-1990	5/35 Sqns	
1412?	Chengdu F-7MB	1989-1990	5/35 Sqns	
1413	Chengdu F-7MB	1989-1990	5/35 Sqns	'Thundercats' titles
1414	Chengdu F-7MB	1989-1990	5/35 Sqns	'Thundercats' titles
1415	Chengdu F-7MB	1989-1990	5/35 Sqns	
1416	Chengdu F-7MB	1989-1990	5/35 Sqns	
1417	Chengdu F-7MB	1989-1990	5/35 Sqns	
1418	Chengdu F-7MB	1989-1990	5/35 Sqns	
1419	Chengdu F-7MB	1989-1990	5/35 Sqns	
1420	Chengdu F-7MB	1989-1990	5/35 Sqns	
1421	Chengdu F-7MB	1989-1990	5/35 Sqns	'Thundercats' titles
1422	Chengdu F-7MB	1989-1990	5/35 Sqns	'Thundercats' titles
1423	Chengdu F-7MB	1989-1990	5/35 Sqns	
1424	Chengdu F-7MB	1989-1990	5/35 Sqns	'Thundercats' titles
1425	Chengdu F-7MB	1989-1990	5/35 Sqns	
1426	Chengdu F-7MB	1989-1990	5/35 Sqns	
1427	Chengdu F-7MB	1989-1990	5/35 Sqns	'Thundercats' titles
1428	Chengdu F-7MB	1989-1990	5/35 Sqns	'Thundercats' titles

Known Bangladesh Air Force FT-7Bs				
Serial	Version	Delivery date	Unit	Comments
1429	Guizhou FT-7B	1990	5/35 Sqns	
1430	Guizhou FT-7B	1990	5/35 Sqns	
1431	Guizhou FT-7B	1990	5/35 Sqns	crashed 25-2-2003
1432	Guizhou FT-7B	1990	5/35 Sqns	
1433	Guizhou FT-7B	1998	5/35 Sqns	crashed 7-1-2001
1434	Guizhou FT-7B	1998	5/35 Sqns	
1435	Guizhou FT-7B	1998	5/35 Sqns	
2429	Guizhou FT-7B	2000	5/35 Sqns	'Thundercats' titles
2430	Guizhou FT-7B		5/35 Sqns	'Thundercats' titles
2431	Guizhou FT-7B		5/35 Sqns	'Thundercats' titles. Crashed 25-2-2003
2432	Guizhou FT-7B		5/35 Sqns	

Known Bangladesh Air Force F-7BGs			
Serial	Version	Delivery date	Unit
932	Chengdu F-7BG	29-3-2006	5/35 Sqns
933	Chengdu F-7BG	29-3-2006	5/35 Sqns
934	Chengdu F-7BG	29-3-2006	5/35 Sqns
935	Chengdu F-7BG	29-3-2006	5/35 Sqns
936	Chengdu F-7BG	29-3-2006	5/35 Sqns
?	Chengdu F-7BG	29-3-2006	
?	Chengdu F-7BG	29-3-2006	

A trio of Bangladesh Air Force F-7MBs carrying two drop tanks each display the tail badge and 'Thundercats' titles of the No. 35 Sqn. ▼

via Internet

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▲
1429, one of the 5/35 Squadrons' short-fuselage FT-7B trainers.

◄ ▲ ◄
FT-7BGs 944 and 945 show this version's longer fuselage and built-in cannon.

F-7BGs 935 and 936 line up for a formation take-off.
▼

Bulgaria

The **Bulgarian Air Force** (*Bulgarski Voyenno Vozdushshni Sili*), usually abbreviated to BVVS, was the subject of a major reorganisation in 1961 occasioned by the government's acceptance of missiles as the primary weapon of both defence and attack. Both the Air Force and the Army heavy anti-aircraft artillery and missiles were integrated into the Air Defence Force and Air Force (PVOiVVS – *Protivovazdushna Otbrana i Voennovazdushni Sili*), which was organised on

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Soviet lines; it was roughly the equivalent of a Soviet PVO Air Army. All Bulgarian aviation assets, with the exception of the small naval force, were vested in the PVOiVVS.

In September 1963 the PVOiVVS took delivery of 12 MiG-21F-13s (*izdeliye* 74). The new aircraft were taken from the 10th and 11th batches of production at Moscow *zavod* 30 'Znamya Truda', which in 1962 had introduced a production line for export customers; the factory at Gor'kiy having switched to building a later model, the MiG-21PF, for the Soviet Air Force. The MiG-21F-13s were all initially based at Graf Ignatievo AB, Burgas, with 2 *Iztrebitelna Avioeskadrila* (IAE – Fighter Squadron) of the 19 *Iztrebitelen Aviopolk* (IAP – Fighter Regiment), that is, 2/19 IAE.

In 1974 all existing MiG-21F-13 fighters were transferred to 1/26 *Razuznavatelna Avioeskadrila* (RAE – Reconnaissance Air Squadron) at Dobrich (prior to 1990 known as Tolbukhin). By 1976 they had been fitted with an AFA-39 camera, receiving the unofficial local designation **MiG-21F-13R**.

The surviving nine MiG-21F-13Rs were withdrawn from service in 1988, three having crashed. Some aircraft deactivated under the Conventional Forces in Europe (CFE) Treaty had the national insignia painted out and additional identification numbers applied to the forward and rear fuselage, as indicated in the tables below.

The next version of the *Fishbed* to arrive was the MiG-21PF (*izdeliye* 76) all-weather fighter, of which 12 were delivered in January 1965 to Gabrovnitsa for 2/18 IAE. They were from the 8th and 9th batches built at MMZ No. 30 'Znamya Truda', Moscow. About eight were transferred in 1984 to 2/21 IAE at Uzundzhovo. There they served until 1988 when all surviving MiG-21PFs were redeployed to 1/26 RAE to replace the reconnaissance-configured MiG-21F-13 that had been withdrawn from service.

Eric Dewhurst

Detlev Grass

◄▲
MiG-21*bis* '513 White' with current Bulgarian Air Force roundels and MiG-21MF '613 White' wearing the old star insignia illustrate the different camouflage schemes worn by Bulgarian MiG-21s.

Bulgarian Air Force MiG-21F-13s

Serial	Version	C/n	Delivery date	First unit	Comments
501 White	MiG-21F-13	741101	9-1963	2?/19 IAE	AFA-39 camera fitted 1984 and moved to 1/26 RAE, preserved Plovdiv, light green/dark green/tan camouflage, old insignia
511 White	MiG-21F-13	741011	9-1963	2?/19 IAE	
512 White	MiG-21F-13	741012	9-1963	2?/19 IAE	
513 White	MiG-21F-13	741013	9-1963	2?/19 IAE	AFA-39 camera fitted 1984 and moved to 1/26 RAE
514 White	MiG-21F-13	741014	9-1963	2?/19 IAE	
515 White	MiG-21F-13	741015	9-1963	2?/19 IAE	AFA-39 camera fitted 1984 and moved to 1/26 RAE noted 21-8-2002 stored Graf Ignatievo AB, light green/dark green/tan camouflage, no insignia, CFE identifier '6'
516 White	MiG-21F-13	741016	9-1963	2?/19 IAE	AFA-39 camera fitted 1984 and moved to 1/26 RAE, noted 21-8-2002 stored Graf Ignatievo AB with CFE identifier '7', later preserved Kamenets as '07'
517 White	MiG-21F-13	741017	9-1963	2?/19 IAE	
518 White	MiG-21F-13	741018	9-1963	2?/19 IAE	AFA-39 camera fitted 1984 and moved to 1/26 RAE, noted 10-2002 preserved Raduil
519 White	MiG-21F-13	741019	9-1963	2?/19 IAE	
520 White	MiG-21F-13	741020	9-1963	2?/19 IAE	AFA-39 camera fitted 1984 and moved to 1/26 RAE noted 21-8-2002 stored Graf Ignatievo AB, light green/dark green/tan camouflage, no insignia, CFE identifier '8'
?	MiG-21F-13	?	9-1963	2/19 IAE?	Crashed

Bulgarian Air Force MiG-21PFs					
Serial	**Version**	**C/n**	**Delivery date**	**First unit**	**Comments**
20	MiG-21PF	760804	1-1965	2/18 IAE	Preserved Plovdiv
21	MiG-21PF	760805	1-1965	2/18 IAE	Crashed 1975
022	MiG-21PF	760808	1-1965	2/18 IAE	
223	MiG-21PF	760813	1-1965	2/18 IAE	Preserved BVVS HQ, Sofia, as 123 White in dark green/brown camouflage, new insignia
224	MiG-21PF	760814	1-1965	2/18 IAE	
125	MiG-21PF	760815	1-1965	2/18 IAE	Preserved Kamenets as '123'
26?	MiG-21PF	760904	1-1965	2/18 IAE	Written off before 1981
27?	MiG-21PF	?	1-1965	2/18 IAE	Written off before 1981
28	MiG-21PF	760908	1-1965	2/18 IAE	
29	MiG-21PF	760909	1-1965	2/18 IAE	
030	MiG-21PF	760910	1-1965	2/18 IAE	
31	MiG-21PF	760911	1-1965	2/18 IAE	

Note: When three-digit serials were used for the MiG-21PFs, the first digit was spurious and had been added and even changed occasionally to confuse NATO observers.

The surviving eight MiG-21PFs were retired in 1991, four having been lost in accidents.

In 1965 twelve MiG-21PFM (*izdeliye* 94A) interceptors were delivered to 1/15 IAE at Ravnets from *zavod* 21 in Gor'kiy. This variant was a development of the MiG-21PF with blown flaps, a larger tailfin, a parabrake relocated to a fairing below the rudder and a new KM-1 ejection

Bulgarian Air Force MiG-21PFM preserved in Burgas
39
Bulgarian Air Force MiG-21PFM preserved in Plovdiv
62
Bulgarian Air Force MiG-21PFM preserved at Graf Ignatievo AB
66

Bulgarian Air Force MiG-21PFSs and MiG-21PFMs

Serial	Version	C/n	Line no.	Delivery date	First unit	Comments
25	MiG-21PFM	940 SO 12	0312	1965	1/15 IAE	
26	MiG-21PFM	940MK10	2910	1965	1/15 IAE	
27	MiG-21PFM	940MA08	2108	1965	1/15 IAE	
28	MiG-21PFM	940 MO 18	2318	1965	1/15 IAE	
29	MiG-21PFM	940MT09	2609	1965	1/15 IAE	
30	MiG-21PFM	940 OA 10	3110	1965	1/15 IAE	
31	MiG-21PFM	940 MO 23	2323	1965	1/15 IAE	
32	MiG-21PFM	940ME22	2522	1965	1/15 IAE	Preserved Plovdiv-Krumovo
33	MiG-21PFM	940 MI 23	2823	1965	1/15 IAE	
34	MiG-21PFM	940 OA 04	3104	1965	1/15 IAE	Crashed 5-10-1989
35	MiG-21PFM	940MK05	2905	1965	1/15 IAE	Crashed 10-4-1969
36 White	MiG-21PFM	940 MO 05	2305	1965	1/15 IAE	Preserved Air Academy, Dolna Metropolija, green/tan camouflage, new insignia, flying heron nose art
37	MiG-21PFM	940 MO 06	2306	1977-78		
38	MiG-21PFM	940 MO 07	2307	1977-78		
39 Red	MiG-21PFM	940 MO 08	2308	1977-78		Preserved Burgas, green/tan camouflage, old insignia
40	MiG-21PFM	940 MO 09	2309	1977-78		Preserved Air Academy, Dolna Metropolija, CFE identifier '26'
41	MiG-21PFM	940 MO 10	2310	1977-78		Preserved Sadovo
42	MiG-21PFM	940 MO 11	2311	1977-78		
43 White	MiG-21PFM	940 MO 13	2313	1977-78		Noted 21-8-2002 stored Graf Ignatievo AB, green/tan camouflage, no insignia; noted 2007 preserved in a children's playground in Germany
44	MiG-21PFM	940 MO 15	2315	1977-78		
45	MiG-21PFM	940 MO 16	2316	1977-78		
46	MiG-21PFM	940 MO 17	2317	1977-78		
47	MiG-21PFM	940 OA 12	3112	1977-78		
48	MiG-21PFM	940 OS 13	3013	1977-78		
50	MiG-21PFM	940ACh23	1723	1977-78		
51	MiG-21PFM	940ACh09	1709	1977-78		
61	MiG-21PFM	940 OS 14	3014	1977-78		
62 White	MiG-21PFM	940ME10	2510	1977-78		Pres. Plovdiv as '7294', lt green/dk green/tan camouflage, old insignia, nose art
63	MiG-21PFM	940 OS 17	3017	1977-78		
64	MiG-21PFM	940MK03	2903	1977-78		
65	MiG-21PFM	940 OS 18	3018	1977-78		Preserved Balchik
66 White (1)	MiG-21PFM	940 OS 03	3003	1977-78		Preserved Graf Ignatievo AB, light green/dark green/brown camouflage, new insignia. See MiG-21MF table
67	MiG-21PFM	940MK20	2920	1977-78		CFE identifier '15'. Preserved Sofia Military Museum
68 White	MiG-21PFM	940MT04	2604	1986	1/2 UBAE	Noted 21-8-2002 stored Graf Ignatievo AB, two-tone green camouflage, no insignia; CFE identifier '4' assigned but not visible
69	MiG-21PFM	940 OS 19	3019	1977-78		
70	MiG-21PFM	940ML02	2402	1977-78		
71	MiG-21PFM	940 MI 24	2824	1977-78		
73	MiG-21PFM	940MM20	2220	1977-78		
74	MiG-21PFM	940MA19	2119	1977-78		Noted 4-2003 stored Graf Ignatievo
75	MiG-21PFM	940ACh10	1710	1977-78		Noted 21-8-2002 stored Graf Ignatievo AB, CFE identifier '24'
76	MiG-21PFM	940 MI 12	2812	1977-78		
77	MiG-21PFM	940ACh13	1713	1977-78		
85	MiG-21PFM	940ACh15	1715	1977-78		Also reported as '68', probably in error
86	MiG-21PFM	?		1977-78		
940	MiG-21PFM	940MK13	2913	1986	1/2 UBAE	Preserved Air Academy, Dolna Metropolija, two-tone green camouflage, obvious signs of reserialling
49	MiG-21PFS	N94211516		1977-78		
72	MiG-21PFS	N94211508		1977-78		
78 White	MiG-21PFS	N94211511		1977-78		Noted 21-8-2002 stored Graf Ignatievo AB, obviously reserialled, green/tan camouflage, no insignia, CFE identifier '3'

Bulgarian Air Force MiG-21Rs					
Serial	Version	C/n	Delivery date	First unit	Comments
130	MiG-21R	94R01420	1969	1/26 RAE	
223	MiG-21R	94R01713	1969	1/26 RAE	
224	MiG-21R	94R01714	1969	1/26 RAE	
231	MiG-21R	94R01421	1969	1/26 RAE	
325	MiG-21R	94R01715	1969	1/26 RAE	Noted 21-8-2002 stored Graf Ignatievo AB
326 White	MiG-21R	94R01716	1969	1/26 RAE	Light green/dark green/brown camouflage. Noted 21-8-2002 stored Graf Ignatievo AB, rear fuselage missing

Bulgarian Air Force MiG-21Ms					
Serial	Version	C/n	Delivery date	First unit	Comments
101	MiG-21M	960701	8-1969	2/19 IAE	Crashed 21-6-1977
108 White	MiG-21M	960608	8-1969	2/19 IAE	Noted 21-8-2002 stored Graf Ignatievo AB, green/brown camouflage, no insignia; CFE identifier '1' assigned but not worn visibly
109	MiG-21M	962309	8-1969	2/19 IAE	
202 White	MiG-21M	960702	8-1969	2/19 IAE	Light green/dark green/brown camouflage. Noted 21-8-2002 stored Graf Ignatievo AB with insignia and serial painted out and a large 'E' painted on the nose
209	MiG-21M	960609	8-1969	2/19 IAE	
210 White	MiG-21M	962310	8-1969	2/19 IAE	Noted 21-8-2002 stored Graf Ignatievo AB, green/brown camouflage, no insignia, CFE identifier '2'
303	MiG-21M	960703	8-1969	2/19 IAE	
310	MiG-21M	960610	8-1969	2/19 IAE	
311	MiG-21M	962311	8-1969	2/19 IAE	Noted 21-8-2002 stored Graf Ignatievo AB
404	MiG-21M	960704	8-1969	2/19 IAE	Crashed 17-6-1984
411	MiG-21M	960611	8-1969	2/19 IAE	Preserved Uzundzhovo
512	MiG-21M	960612	8-1969	2/19 IAE	Crashed 3-11-1971
613 White	MiG-21M	960613	8-1970	2/19 IAE	Preserved Plovdiv-Krumovo, light green/dark green/brown camouflage, old insignia
714	MiG-21M	960614	8-1970	2/19 IAE	Crashed 26-8-1974
815	MiG-21M	960615	8-1970	2/19 IAE	Crashed 17-9-80

seat, and hence a fixed windshield and a hinged canopy opening to starboard.

Between December 1977 and April 1978 the BVVS received 32 more MiG-21PFMs (*izdeliye* 94) built in the mid-1960s but later relegated by the Soviet Air Force to surplus stock. Also supplied at about the same time from surplus stock were four MiG-21PFS (also *izdeliye* 94A) which were identical to the MiG-21PFM apart from the cockpit and ejection seat, identical to those fitted on the MiG-21PF. A final delivery of two MiG-21PFMs took place in 1986, making a grand total of 46 (plus the four MiG-21PFSs).

The OKB retained the same *izdeliye* 94 product code for both variants, which were coming off the production lines at zavod 21 at this time, thus causing confusion, particularly with construction numbers. The first nine batches of the MiG-21PFS had received the same narrow-chord fin as the MiG-21PF, all later batches had the enlarged fin of the MiG-21PFM (*izdeliye* 94A) and subsequent variants but all the aircraft sent to Bulgaria had the larger tailfin.

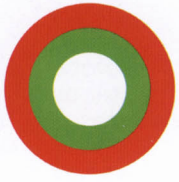
The entire 1965 batch served at first with 15 IAP at Ravnets; subsequent deliveries went to 2/15 IAE at Baltchik, 1/15 IAE at Ravnets and 2/18 IAE at Gabrovnitsa. The last mentioned were replaced in 1984 by MiG-23MLDs and the MiG-21s transferred to 1/2 UBAE (*Uchebna Boen Avioeskadrila*, Combat Training Air Squadron) at Kamenets.

Seven aircraft were lost in accidents and four exported to Nigeria in 1994. The last unit to use the MiG-21PFM (*izdeliye* 94) was the 12th *Uchebna Aviobasa* (Training Base), alias 1/2 UBAE, at Kamenets, from which all survivors were withdrawn from use in 1992.

The MiG-21R (*izdeliye* 94RA) was the tactical reconnaissance version with a deeper dorsal spine and ECM equipment in wingtip fairings. To increase the range a 490-litre (108 Imp gal) drop tank could be carried under each wing; all the

Bulgarian Air Force MiG-21MFs

Serial	Version	C/n	Line No.	Delivery	First unit	Comments
021	MiG-21MF *	96007021	0603?	10-1975	1/18 IAE	1/19 IAE 1978, 21 IAP 1983-4, 1/26 RAE 1990, noted 9-2002 stored Dobrich
029	MiG-21MF *	96007029	0604?	10-1975	1/18 IAE	1/19 IAE 1978, 21 IAP 1983-4, RAE 1990
033	MiG-21MF *	96007033	0605?	10-1975	1/18 IAE	1/19 IAE 1978, 21 IAP 1983-4, 1/26 RAE 1990
047	MiG-21MF *	96007047	0606?	10-1975	1/18 IAE	1/19 IAE 1978, 21 IAP 1983-4, 1/26 RAE 1990, **cvtd to MiG-21MFR** 1995, noted 9-2002 stored Dobrich
51	MiG-21MF	969401		8-1974	2/19 IAE	21 IAP 1983-4, written off 1988
52 White	MiG-21MF	969402		8-1974	2/19 IAE	21 IAP 1983, 1/26 RAE 1990, preserved Plovdiv-Krumovo, light green/dark green/brown camouflage
55	MiG-21MF	969405		8-1974	2/19 IAE	21 IAP 1983, 1/26 RAE 1990, **converted to MiG-21MFR** 1995, crashed 16-7-1998
57	MiG-21MF	969407		8-1974	2/19 IAE	21 IAP 1983, 1/26 RAE 1990, **converted to MiG-21MFR** 1995, noted 9-2002 stored Dobrich
58	MiG-21MF	969408		8-1974	2/19 IAE	21 IAP 1983, 1/26 RAE 1990, **converted to MiG-21MFR** 1995
64	MiG-21MF	969504		8-1974	2/19 IAE	21 IAP 1983, 1/26 RAE 1990, **converted to MiG-21MFR** 1995, noted 9-2002 stored Dobrich
65	MiG-21MF	969505		8-1974	2/19 IAE	21 IAP 1983-4, 21 IAP 1983-4 crashed 27-1-1984
66 (2)	MiG-21MF	969506		8-1974	2/19 IAE	21 IAP 1983-4, crashed 22-6-1985; see MiG-21PFM table
111	MiG-21MF *	96007111	0607	10-1975	1/18 IAE	1/19 IAE 1978, 21 IAP 1983-4, 1/26 RAE 1990, noted 8-2002 stored Graf Ignatievo AB as '0607', CFE identifier '9'
133	MiG-21MF *	96007133	?	10-1975	1/18 IAE	1/19 IAE 1978, 21 IAP 1983-4, 1/26 RAE 1990, noted 8-2002 stored Graf Ignatievo AB, CFE identifier '21'
151	MiG-21MF *	96007151	?	10-1975	1/18 IAE	1/19 IAE 1978, 21 IAP 1983-4, 1/26 RAE 1990
177	MiG-21MF *	96007177	?	10-1975	1/18 IAE	1/19 IAE 1978, 21 IAP 1983-4, 1/26 RAE 1990, **cvtd to MiG-21MFR** 1995, noted 9-2002 stored Dobrich
213	MiG-21MF *	96007213	?	10-1975	1/18 IAE	1/19 IAE 1978, 21 IAP 1983-4, 1/26 RAE 1990, noted 9-2002 stored Dobrich
247	MiG-21MF *	96007247	?	10-1975	1/18 IAE	1/19 IAE 1978, 21 IAP 1983-4 crashed 22-10-84
301	MiG-21MF *	96007301	?	10-1975	1/18 IAE	1/19 IAE 1978, 21 IAP 1983-4, 1/26 RAE 1990, noted 9-2002 stored Dobrich
403	MiG-21MF	969403		8-1974	2/19 IAE	21 IAP 1983, 1/26 RAE 1990, **converted to MiG-21MFR** 1995, noted 9-2002 stored Dobrich



Well-weathered MiG-21*bis* (*izdeliye* 75B) '392 White' of the 3rd Fighter Brigade taxies at Graf Ignatievo AB. ▼

cameras and other reconnaissance sensors were in a pod on the fuselage centreline. Six MiG-21Rs were delivered in the second half of 1969 to 1/26 RAE at Dobrich. The type was withdrawn from service in 1995.

Built at MMZ No. 30 'Znamya Truda', the MiG-21M (*izdeliye* 96) could be considered the export version of either the MiG-21S or the MiG-21SM: a MiG-21S with a built-in cannon or a MiG-21SM with the less powerful R11F2S-300 replacing the R13-300 engine. It differed externally from the MiG-21SM and the later MiG-21MF by having neither a rear view periscope on the canopy nor gun blast deflector plates below the auxiliary engine inlets. 15 were delivered in 1969 and 1970 to 2/19 IAE at Graf Ignatievo. Survivors were withdrawn from service in 1990.

For the first time the serial of a Bulgarian MiG-21 variant revealed, in the last two digits of the construction number, the count of aircraft in any particular batch. The preceding digit possibly reflected the order of delivery.

Fitted with the R13-300 turbojet, the MiG-21MF (*izdeliye* 96F) was a more powerful version of the MiG-21M with a better radar. Twenty were delivered between August 1974

Chris Lofting

Bulgarian Air Force MiG-21*bis* (part 1 – *Fishbed-N*)					
Serial	**Version**	**C/n**	**Delivery date**	**First unit**	**Comments**
013 White	MiG-21*bis* (izd. 75B)	75094013	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/brown camouflage
025 White	MiG-21*bis* (izd. 75B)	75094025	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Dark green/brown camouflage
027 White	MiG-21*bis* (izd. 75B)	75024027	1985	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/brown camouflage
045 White	MiG-21*bis* (izd. 75B)	75094045	1983	19 IAP	3 IAB, noted 3-2001. Light green/dark green/brown camouflage
088	MiG-21*bis* (izd. 75B)	75094088	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB
101	MiG-21*bis* (izd. 75B)	75094101	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB
102 White	MiG-21*bis* (izd. 75B)	75027102	1985	19 IAP	3 IAB, noted 21-8-2002 active Graf Ignatievo AB. Light green/dark green/brown camouflage
114 White	MiG-21*bis* (izd. 75B)	75094114	1983	19 IAP	3 IAB, noted 21-8-2002 active Graf Ignatievo AB, light green/dark green/brown camouflage
119 White	MiG-21*bis* (izd. 75B)	75094119	1983	19 IAP	3 IAB, noted 1-6-2007 Graf Ignatievo AB. Dark green/brown camouflage
127	MiG-21*bis* (izd. 75B)	75094127	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB
240	MiG-21*bis* (izd. 75B)	75094240	1983	19 IAP	3 IAB, noted 21-8-2002 active Graf Ignatievo AB. To '340 White'
243 White	MiG-21*bis* (izd. 75B)	75094243	1983	19 IAP	3 IAB, noted 1-6-2007 Graf Ignatievo AB. Light green/dark green/brown camouflage
249	MiG-21*bis* (izd. 75B)	75094249	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB
254 White	MiG-21*bis* (izd. 75B)	75094254	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo. Light green/dark green/brown camouflage
261 White	MiG-21*bis* (izd. 75B)	75094261	1983	19 IAP	3 IAB, noted 21-8-2002 active Graf Ignatievo AB. Green/tan camouflage
277	MiG-21*bis* (izd. 75B)	75094277	1983	19 IAP	3 IAB, noted 21-8-2002 Graf Ignatievo AB
294 White	MiG-21*bis* (izd. 75B)	75094294	1983	19 IAP	3 IAB, noted active 21-8-2002. Green/brown camouflage
302 White	MiG-21*bis* (izd. 75B)	75094302	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Grey/green 'zebra' camouflage
317	MiG-21*bis* (izd. 75B)	75094317	1983	19 IAP	3 IAB, noted 21-8-2002 Graf Ignatievo AB
324 White	MiG-21*bis* (izd. 75B)	75094324	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/brown camouflage
340 White	MiG-21*bis* (izd. 75B)	75094240	1983	19 IAP	Ex '240 White', reserialled by 2004. Green/tan camouflage
345 White	MiG-21*bis* (izd. 75B)	75094345	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB, light green/dark green/brown camouflage
358 White	MiG-21*bis* (izd. 75B)	75094358	1983	19 IAP	3 IAB, noted 21-8-2002 Graf Ignatievo AB. Light green/dark green/brown camouflage
362 White	MiG-21*bis* (izd. 75B)	75094362	1983	19 IAP	3 IAB, noted 21-8-2002 Graf Ignatievo AB. Light green/dark green/brown camouflage
365 White	MiG-21*bis* (izd. 75B)	75094365	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB, light green/dark green/brown camouflage
370 White	MiG-21*bis* (izd. 75B)	75094370	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/brown camouflage
383 White	MiG-21*bis* (izd. 75B)	75094383	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/brown camouflage (faded to grey/dark green/brown)
388 White	MiG-21*bis* (izd. 75B)	75094388	1983	19 IAP	3 IAB, noted 1-6-2007 Graf Ignatievo AB. Green/tan 'zebra' camouflage
392 White	MiG-21*bis* (izd. 75B)	75094392	1983	19 IAP	3 IAB, noted active 21-8-2002 Graf Ignatievo AB. Green/tan camouflage
399 White	MiG-21*bis* (izd. 75B)	75094399	1983	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Grey/green camouflage
401	MiG-21*bis* (izd. 75B)	75094401	1983	19 IAP	Crashed 1990
407 White	MiG-21*bis* (izd. 75B)	75094407	1983	19 IAP	3 IAB, noted 21-8-2002 active Graf Ignatievo AB. Green/brown camouflage. To '427 White'
413 White	MiG-21*bis* (izd. 75B)	75094413	1983	19 IAP	3 IAB, noted 21-8-2002 active Graf Ignatievo AB. Light green/dark green/brown camouflage (faded to grey/dark green/brown)
427 White	MiG-21*bis* (izd. 75B)	75094407	1983	19 IAP	Ex '407 White', reserialled by 2004. 3 IAB, noted 1-6-2007 Graf Ignatievo AB. Green/brown camouflage
727	MiG-21*bis* (izd. 75B)	75028727	1985	19 IAP	3 IAB, noted 21-8-2002 active Graf Ignatievo AB
850 White	MiG-21*bis* (izd. 75B)	75028850	1985	19 IAP	3 IAB, noted 21-8-2002 active Graf Ignatievo AB, stored by 2005. Light green/dark green/brown camouflage
903 White	MiG-21*bis* (izd. 75B)	75028903	1985	19 IAP	3 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/brown camouflage
947	MiG-21*bis* (izd. 75B)	75028947	1985	19 IAP	3 IAB, preserved Korten

and October 1975, nine going to 2/19 IAE at Graf Ignatievo AB and eleven to 1/18 IAE at Dobroslavtsi AB near Sofia. In 1978, after 1/18 had switched to MiG-23MFs, their superfluous MiG-21MFs replaced the MiG-19s in 1/19 IAE. 19 IAP changed over to the MiG-21*bis* in 1983-84, passing their MiG-21MFs on to 21 IAP until they, in turn, were replaced in 1990 and moved on yet again, this time to 1/26 RAE. In the course of 1995-96 six MiG-21MFs were modified for the tactical reconnaissance role and locally designated **MiG-21MFR** until finally withdrawn from use in 2000. **MiG-21MF-75** was another local and unofficial designation as far as OKB MiG is concerned, applying to the MiG-21MFs built at Gor'kiy from 1975 onwards with cockpit instrumentation identical to that of the MiG-21*bis*; such aircraft are marked * in the table on page 474.

Bulgarian Air Force MiG-21*bis* (part 2 – *Fishbed-L*)

Serial	Version	C/n	Line number	Delivery date	First Unit	Comments
80 White	MiG-21*bis* (*izd.* 75A)	75001041	?	1990	1/15 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage
81	MiG-21*bis* (*izd.* 75A)	75003092	?	1990	1/15 IAE	6 IAB, noted 9-2002 stored Dobrich
82	MiG-21*bis* (*izd.* 75A)	75003117	?	1990	1/15 IAE	6 IAB, noted 9-2002 stored Dobrich
83	MiG-21*bis* (*izd.* 75A)	75019927	?	1990	1/15 IAE	6 IAB, noted 9-2002 stored Dobrich
84 (1)	MiG-21*bis* (*izd.* 75A)	75033127	?	1990	1/15 IAE	3/19 IAE, renumbered 502 (2)
84 (2)	MiG-21*bis* (*izd.* 75A)	75044702	?	1990	1/15 IAE	ex 502 (1), 6 IAB, noted 9-2002 stored Dobrich
85	MiG-21*bis* (*izd.* 75A)	75054147	?	1990	1/15 IAE	6 IAB, noted 9-2002 stored Dobrich
86 White	MiG-21*bis* (*izd.* 75A)	75003008	?	1990	1/15 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage
87	MiG-21*bis* (*izd.* 75A)	75014898	?	1990	1/15 IAE	6 IAB, noted 9-2002 stored Dobrich
88 White	MiG-21*bis* (*izd.* 75A)	75014904	?	1990	1/15 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage, flying heron nose art
89	MiG-21*bis* (*izd.* 75A)	75034730	?	1990	1/15 IAE	6 IAB, noted 9-2002 stored Dobrich
90 White	MiG-21*bis* (*izd.* 75A)	75080614	?	1990	1/15 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage, flying heron nose art
91	MiG-21*bis* (*izd.* 75A)	75080645	?	1990	1/15 IAE	6 IAB, noted 9-2002 stored Dobrich
92	MiG-21*bis* (*izd.* 75A)	75053407	?	1990	1/15 IAE	6 IAB, noted 9-2002 stored Dobrich
93	MiG-21*bis* (*izd.* 75A)	75053569	?	1990	1/15 IAE	6 IAB, noted 9-2002 stored Dobrich
94	MiG-21*bis* (*izd.* 75A)	75080601	?	1990	1/15 IAE	6 IAB, noted 9-2002 stored Dobrich
95	MiG-21*bis* (*izd.* 75A)	75034681	?	1990	1/15 IAE	6 IAB, noted 9-2002 stored Dobrich
96 White	MiG-21*bis* (*izd.* 75A)	75034745	?	1990	1/15 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage, flying heron nose art
97	MiG-21*bis* (*izd.* 75A)	?	?	1990	1/15 IAE	6 IAB, crashed 28-12-94
501 White	MiG-21*bis* (*izd.* 75A)	75019901	1317	1990	3/19 IAE	6 IAB, preserved Sofia Military Museum. Green/tan/brown camouflage
502 (1)	MiG-21*bis* (*izd.* 75A)	75044702	?	1990	3/19 IAE	1/15 IAE, 6 IAB, renumbered 84 (2)
502 White (2)	MiG-21*bis* (*izd.* 75A)	75033127	?	1990	3/19 IAE	Ex 84 (1), 6 IAB, noted 21-8-2002 stored Graf Ignatievo. Light green/dark green/tan/brown camouflage, nose art
503 White	MiG-21*bis* (*izd.* 75A)	75007003	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage
509 White	MiG-21*bis* (*izd.* 75A)	75012409	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage
513 White	MiG-21*bis* (*izd.* 75A)	75003013	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Green/tan/brown camouflage
515	MiG-21*bis* (*izd.* 75A)	75017715	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB
516 White	MiG-21*bis* (*izd.* 75A)	75016609	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage
517 White	MiG-21*bis* (*izd.* 75A)	75017009	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage
520 White	MiG-21*bis* (*izd.* 75A)	75007420	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Green/tan/brown camouflage
523 White	MiG-21*bis* (*izd.* 75A)	75007023	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage
525 White	MiG-21*bis* (*izd.* 75A)	75003025	?	1990	3/19 IAE	6 IAB. Green/tan/brown camouflage. Preserved Sofia National Historical Museum
530 White	MiG-21*bis* (*izd.* 75A)	75007030	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage
545	MiG-21*bis* (*izd.* 75A)	75034645	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB
550 White	MiG-21*bis* (*izd.* 75A)	75011350	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage
553 White	MiG-21*bis* (*izd.* 75A)	75017953	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Green/tan/brown camouflage
558	MiG-21*bis* (*izd.* 75A)	75006258	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB, noted 2007 preserved in a park in Byala Slatina
559 White	MiG-21*bis* (*izd.* 75A)	75008059	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage
561 White	MiG-21*bis* (*izd.* 75A)	75003061	?	1990	3/19 IAE	6 IAB, noted 21-8-2002 stored Graf Ignatievo AB. Light green/dark green/tan/brown camouflage

Bulgarian Air Force MiG-21USs				
Serial	Version	C/n	Delivery date	Comments
02	MiG-21US	?	1969	
03	MiG-21US	?	1970	Sold to Nigeria 1992
04	MiG-21US	?	1970	
05 Red	MiG-21US	07685143	1970	Preserved Plovdiv-Krumovo, overall silver finish
06	MiG-21US	?	1970	

Bulgarian Air Force MiG-21UMs				
Serial	Version	C/n	Delivery date	Comments
07 White	MiG-21UM	516913016	1974	Green/brown camouflage. Preserved Kamenets
08 White	MiG-21UM	516913021		Noted stored Graf Ignatievo AB 21-8-2002; green/grey camouflage, silver-painted nose
09 White	MiG-21UM	516913026		Noted stored Graf Ignatievo AB 21-8-2002, green/tan camouflage, silver-painted nose
10 White	MiG-21UM	516913031		Noted stored Graf Ignatievo AB 21-8-2002, green/tan camouflage, silver-painted nose
11	MiG-21UM	516921041		
12	MiG-21UM	516921046		
13 White	MiG-21UM	516939036		Noted stored Graf Ignatievo AB 21-8-2002. Light green/dark green/brown camouflage
14	MiG-21UM	516939041		Noted stored Dobrich 9-2002
15	MiG-21UM	516979041		Noted stored Dobrich 9-2002
16	MiG-21UM	516979046		
17	MiG-21UM	516979051		Noted stored Dobrich 9-2002
18 White	MiG-21UM	516979056		Green/grey camouflage. Noted stored Graf Ignatievo AB 21-8-2002
19 White	MiG-21UM	516995021		3 IAB, noted active Graf Ignatievo AB 21-8-2002, green/tan camouflage, silver-painted nose
20	MiG-21UM	516995026		
21 White	MiG-21UM	516999258		Noted stored Graf Ignatievo AB 21-8-2002, green/tan 'zebra' camouflage, silver-painted nose
22	MiG-21UM	516999262		
23	MiG-21UM	516999236		Crashed 2-6-1999
24 White	MiG-21UM	516999257		Green/grey camouflage. Noted stored Graf Ignatievo AB 21-8-2002
25 White	MiG-21UM	516999261		Green/grey camouflage. Noted Graf Ignatievo AB 21-8-2002, stored by 2005
26	MiG-21UM	516999264		
27 White	MiG-21UM	516999266		3 IAB, noted active Graf Ignatievo AB 1-6-2007; green/tan camouflage, later green/brown camouflage, silver-painted nose
28	MiG-21UM	516999375		
29 White	MiG-21UM	516999377		Noted stored Graf Ignatievo AB 21-8-2002, noted active 1-6-2007; light green/dark green/tan camouflage, faded to grey/brown
30	MiG-21UM	516999408	1981	
31	MiG-21UM	516999409		
32	MiG-21UM	516999414		
33	MiG-21UM	516999413	1984	Crashed 28-1-1992
34 White	MiG-21UM	516977066	1990	Noted stored 21-8-2002 Graf Ignatievo AB, later preserved Plovdiv-Krumovo, green/tan/brown camouflage
35 White	MiG-21UM	516979021	1990	Noted stored 21-8-2002 Graf Ignatievo AB, green/tan/brown camouflage, flying heron nose art
36 White	MiG-21UM	516999133	1990	Dark green/dark earth camouflage. 3 IAB, noted active 21-8-2002 Graf Ignatievo AB
37	MiG-21UM	516945036	1990	
38 White	MiG-21UM	516979001	1990	Noted Graf Ignatievo AB 21-8-2002, green/tan/brown camouflage
39	MiG-21UM	516993051	1990	3 IAB, noted stored Graf Ignatievo AB 21-8-2002

(Note: The information on the initial units and subsequent movements of the MiG-21MFs has not been confirmed.)

The ultimate version of the MiG-21 was the MiG-21*bis* (*izdeliye* 75), being produced for both home and export markets at zavod 21, Gor'kiy. The two domestic versions with different avionics (*Fishbed-L*/*N*) were both designated *izdeliye* 75, while their export equivalents differing in IFF equipment were *izdeliye* 75A (referred to outside the USSR as the MiG-21*bis* Lazur') with beam and beacon receivers and *izdeliye* 75B (aka

MiG-21*bis* SAU) with the SAU-23ESN automatic flight control system permitting approach with a cloudbase not lower than 100 m (330 ft) and a horizontal visibility of up to 1,000 m (0.62 miles).

30 brand-new MiG-21*bis* (*izdeliye* 75B) fighters were delivered in 1983, followed by six more from Soviet VVS stock in 1985, all of which were used to replace earlier variants of the MiG-21 in two *eskadrila* of 19 IAP at Graf Ignatievo.

Thirty-six MiG-21*bis* (*izdeliye* 75A) fighters were delivered in 1990 from Soviet Air Force stocks to 1/15 IAE at Balchik and 3/19 IAE at Uzundzhovo.

In the 1992 reorganisation the BVVS was reborn with two *Korpus* (Corps): *Protivovazdushna Otbrana* (PVO – Air Defence Corps) and *Takticheski Aviatsia* (TA – Tactical Aviation Corps). The regimental system was retained and MiG-21s equipped the following organisations:

- 2/15 and 3/15 IAE with MiG-21*bis* (*izdeliye*. 75A) and MiG-21UM at Ravnets with the *Korpus* PVO;
- 1/19 and 2/19 IAE with MiG-21*bis* (*izdeliye* 75B) at Graf Ignatievo with the *Korpus* TA;

Plus two direct reporting units:

- 1/26 RAE with MiG-21MFR at Dobrich
- 12th Combat Training Regiment, part of the Higher Air Force School at Kamenets with assorted MiG-21 variants – mostly MiG-21PFMs and MiG-21UMs.

A further reorganisation was made in September 1994 to bring Bulgaria into line with other NATO countries, such as Turkey, when the two *Korpus* were retained but the regimental system was replaced by one founded on air bases. By 2005 the MiG-21*bis* (*izdeliye* 75A) had been withdrawn from service but there were still one unit with the Fishbed:

1st *Eskadrila*, 3 *Istrebitelna Aviatsionna Baza*, Graf Ignatievo AB, is currently the sole remaining Bulgarian unit operating the type, with about eighteen MiG-21*bis* (*izdeliye* 75B) and three MiG-21UMs. By mid-2007 twelve MiG-21 fighters and trainers remained operational.

The 26th *Razuznavatelna Aviatsionna Basa* was disbanded in 2001 and the 12 *Uchebna Aviatsionna Basa* is currently using the Aero L-39ZA Albatros.

Presumably the earlier delivered MiG-21*bis* (*izdeliye* 75B) was preferred because the Soviet GCI system fitted to the MiG-21*bis* (*izdeliye* 75A) was not required.

The first trainer version delivered to the PVOiVVS in 1966 was a MiG-21U (*izdeliye* 66-400), '01 White' (c/n 662216), manufactured at MMZ No. 30 Znamya Truda in Moscow. By that time three different types of MiG-21 fighters were in service in Bulgaria – the MiG-21F-13, MiG-21PF and MiG-21PFM (*izdeliye* 94A); the sole two-seater was shared between their three regiments – the 19 IAP, 18 IAP and 15 IAP respectively. This aircraft is now preserved at the Air Academy in Dolna Metropoliya, wearing the current light green/dark green/grey camouflage and roundels.

Another delivery took place in 1969 but this time a single example of the MiG-21US (*izdeliye*

Bulgarian Air Force MiG-21*bis* (*izdeliye* 75A), 3/19 IAE, Graf Ignatievo AB

Bulgarian Air Force MiG-21*bis* (*izdeliye* 75A), 3/19 IAE, Graf Ignatievo AB

68A), '02 White', arrived from *zavod* 31 *imeni Dimitrova* in Tbilisi. This was followed by four more of a similar type in 1970 and the MiG-21US was finally withdrawn in the 1990s. Two were written off in accidents, one sold to Nigeria and the other two were retired in 1992.

The MiG-21UM (*izdeliye* 69A) was the ultimate trainer version and 27 were delivered from Tbilisi between 1974 and 1982. A further six (*izdeliye* 69) were obtained from surplus Soviet stock in 1990 as attrition replacements. Three still serve with 3 IAB at Graf Ignatievo AB where about a dozen were still in store a few years ago whilst some were sold to India in 1994. Eight are known to have been written off in accidents.

To comply with the terms of the CFE Treaty the gun sights and weapons pylons of some active examples were removed and they were given the local designation **MiG-21UM-2**.

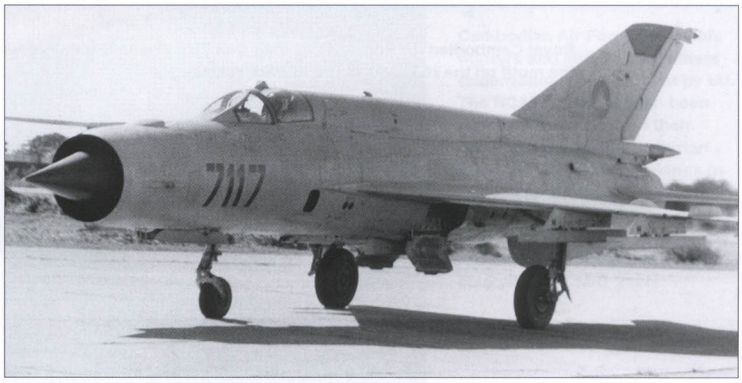
Burkina Faso

On 5th August 1960 the French colony of Upper Volta became the Republic of Burkina Faso. With French assistance, an *Escadrille de Burkina Faso* was formed in 1964 and later developed into the *Force Aérienne de Burkina Faso*. However, from the mid-1970s, military aid came mostly from the USSR and in 1984 eight MiG-21*bis* (*izdeliye* 75A) fighters and two trainers, probably MiG-21UM (*izdeliye* 69A) variants, were delivered to Ouagadougou Air Base for the *Escadrille de Chasse* (Fighter Sqn). Some sources suggest the MiG-21s came from Algeria; whether they were supplied by the Algerian Air Force or just routed through from the Soviet Union is not clear. By 1993, the survivors were all non-operational and stored at the base.

One example has been recorded, a MiG-21*bis* serialled 75 Red. It was still in storage at Ouagadougou in 1997.

Cambodia

The Royal Cambodian Air Force was created on 1st April 1954 after Cambodia became independent of France during the previous year. After seeking first French, then American help in their border struggles with Vietnam in the 1960s, the government turned to the USSR and later also to China for aircraft. An Army coup in 1970 was followed by a US and South Vietnamese invasion to eliminate Vietnamese communists. General Lon Nol took over the government and Prince Norodom Sihanouk fled to China. The country was renamed the Khmer Republic. Indigenous communist guerrillas (*Khmer Rouge*) led by Pol Pot gradually won control of the country and after bitter fighting the capital Phnom Penh fell in April 1975 and the country was renamed Kampuchea – then supported by China who re-equipped the Khmer Rouge Air Force. Vietnam



Detlev Grass

▲
'7117 Red', a Royal Cambodian Air Force MiG-21*bis*.

A Cambodian MiG-21UM and MiG-21*bis* fighters in storage at Phnom Penh-Pochentong.
▼

via Internet

via Internet

Royal Cambodian Air Force MiG-21bis, Unit 701, Phnom Penh-Pochentong;
the motif on the roundels is the Angkor Wat temple
7119
Royal Cambodian Air Force MiG-21UM, Unit 701
7114

Royal Cambodian Air Force MiG-21*bis* fighters

Serial	Version	C/n	Delivery date	Unit	Comments
7101	MiG-21*bis*	75096284	1982	Unit 701, Fighter Sqn	Stored Pochentong
7102	MiG-21*bis*	75096289	1982	Unit 701, Fighter Sqn	Overhauled by IAI 1999, noted active Pochentong 2000
7103	MiG-21*bis*	75096435	1982	Unit 701, Fighter Sqn	Noted 2000 withdrawn from use Pochentong
7104	MiG-21*bis*	75096246	1982	Unit 701, Fighter Sqn	Stored Pochentong
7105	MiG-21*bis*	75096238	1982	Unit 701, Fighter Sqn	Stored Pochentong
7106	MiG-21*bis*	75096409	1982	Unit 701, Fighter Sqn	Stored Pochentong
7107	MiG-21*bis*	75096253	1982	Unit 701, Fighter Sqn	Stored Pochentong
7108	MiG-21*bis*	?	1982	Unit 701	Not noted since 1993
7109	MiG-21*bis*	75096261	1982	Unit 701, Fighter Sqn	Noted 2000 withdrawn from use Pochentong
7110	MiG-21*bis*	75096424	1982	Unit 701, Fighter Sqn	Noted 2000 withdrawn from use Pochentong
7111	MiG-21*bis*	75096328	1982	Unit 701, Fighter Sqn	Stored Pochentong
7112	MiG-21*bis*	75096320	1982	Unit 701, Fighter Sqn	Stored Pochentong
7113	MiG-21*bis*	?	1982	Unit 701	
7116	MiG-21*bis*	75097417	1982	Unit 701, Fighter Sqn	Stored Pochentong
7117	MiG-21*bis*	75097442	1982	Unit 701, Fighter Sqn	Stored Pochentong
7118	MiG-21*bis*	?	1982	Unit 701, Fighter Sqn	Noted IAI, Israel 2000
7119	MiG-21*bis*	75097461	1982	Unit 701, Fighter Sqn	Stored Pochentong
7120	MiG-21*bis*	75097468	1982	Unit 701, Fighter Sqn	Stored Pochentong
7121	MiG-21*bis*	75097504	1982	Unit 701, Fighter Sqn	Stored Pochentong

Royal Cambodian Air Force MiG-21UMs

Serial	Version	C/n	Delivery date	Unit	Comments
7114	MiG-21UM	516999468	1982	Unit 701, Fighter Sqn	Overhauled IAI 1999, noted active Pochentong 2000
7115	MiG-21UM	516999470	1982	Unit 701, Fighter Sqn	Stored Pochentong
7122	MiG-21UM	516999499	1982	Unit 701, Fighter Sqn	Noted 2002 IAI, Israel

invaded in 1978 and set up a puppet government while the Khmer Rouge fought a guerrilla war against their authority. In 1982 help arrived from the USSR in the form of 19 second-hand MiG-21*bis* (*izdeliye* 75B) fighters and three MiG-21UM trainers, which received an overall grey finish and red serials commencing 71 to commemorate 7th January 1979, the date of the overthrow of the Khmer Rouge. The MiG-21s

Dettev Grass

IAI

◄
Cambodian Air Force MiG-21*bis* fighters and MiG-21UM trainers undergoing refurbishment by IAI. The RCAF roundels have been overpainted to conceal their ownership. Note the ex-Syrian MiG-23ML in Israeli markings in the background.

◄◄
A Cambodian pilot poses in the cockpit of his MiG-21*bis*.

belonged to Unit 701 based at Phnom Penh-Pochentong airport.

Soviet assistance, however, stopped in 1989 and lack of spares and money to purchase them eventually led the fighters to be grounded; the last flight took place on 17th June 1992. The surviving aircraft were put into storage on the military ramp at Pochentong. After a general election in 1993 Prince Sihanouk returned as King and the **Royal Cambodian Air Force** was re-formed, Unit 701 becoming The Fighter Squadron. It was planned that Israeli Aircraft Industries (IAI) would refurbish and upgrade 12 MiG-21*bis* (some sources suggest nine single-seaters plus one MiG-21UM) to MiG-21-2000 standard but, after another change of government, the US and The World Bank cut their aid and the deal fell through, with four aircraft still in Israel. In August 1999 the IMF agreed a substantial loan after the Khmer Rouge leaders were put on trial, which allowed one MiG-21*bis* and one MiG-21UM to be overhauled in Israel and returned to Cambodia. Negotiations then took place with the Ukraine for further, cheaper, overhauls.

A photo also exists of a MiG-21*bis* in two-tone green camouflage and wearing the serial '722 Blue'; the markings look like the Cambodian roundels with the stylised image of the Angkor Wat temple but it's hard to be sure.

Three MiG-21UM (*izdeliye* 69A) trainers were also delivered by Bulgaria in 1982; all had been put into storage by 1992. One was overhauled in Israel and returned to Cambodia but another was still in Israel in 2002.

China

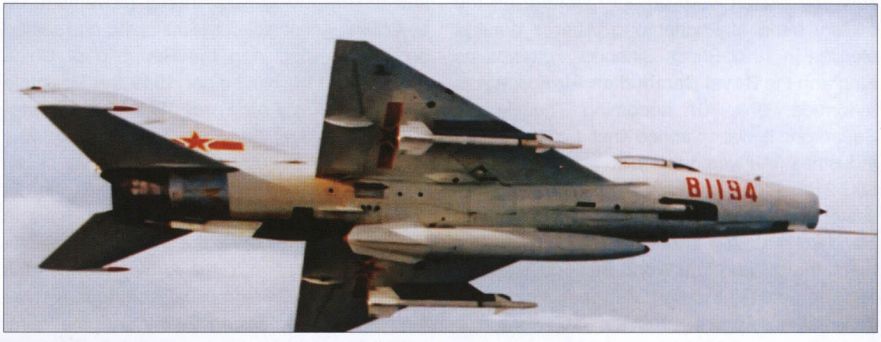
At the end of the Second World War in 1945 two sides fought a civil war to determine who would dominate China after the Japanese were defeated. In 1949 the Communists prevailed, creating the People's Republic of China (PRC), and the opposing Kuomintang movement led by Chiang Kai-shek left the mainland and settled on Taiwan, declaring the Republic of China (RoC). On 11th November 1949 the **People's Liberation Army Air Force** (PLAAF, or *Chung-kuo Shen Min Taie-Fang-Tsun Pu-tai*) was created. The country was divided into seven Military Regions, each of which has an air component; larger Military Regions have a separate Air Corps but in the smaller ones the Air Divisions report first to the Army HQ within the Region. An Air Division usually comprises three Air Regiments (*Feixung Tuan*) and the numbering system presupposes 50 divisions: the 1st Air Division has three regiments numbered 1st, 2nd and 3rd; the 2nd Air Division also has three regiments, which are numbered 4th, 5th and 6th and so on until the 50th Air Division is reached, which has 148th, 149th and 150th. When the number of Air Divisions is reduced, blanks are created within the numbering structure so that an Air Division and its regiments if still extant retain the same number. Each fighter regiment usually has an establishment of 40 aircraft.

The tactical code numbers carried by Chinese military aircraft until June 2005 comprised, with a few exceptions, five digits, say ABCDE; A and D are a code for the divisional number (see decoding tables on pages 482-3)

The badge of the People's Liberation Army Air Force as worn on the uniform.
▼

PLAAF and PLANAF tactical code (div					
D_	1	2	3	4	5
A_					
1		1st Div.	2nd Div.	3rd Div.	4th Div.
2	20th Div.	21st Div.	22nd Div.	23rd Div.	24th Div.
3	10th Div.	11th Div.	12th Div.	13th Div.	14th Div.
4	40th Div.	41st Div.	42nd Div.	43rd Div.	44th Div.
5	30th Div.	31st Div.	32nd Div.	33rd Div.	34th Div.
6	1st Flight Academy	2nd Flight Academy	3rd Flight Academy	4th Flight Academy	5th Flight Academy
7					
8	1st Naval Div.	2nd Naval Div.	3rd Naval Div.	4th Naval Div.	5th Naval Div.

PLAAF and PLANAF tactical code (di					
D_	0	1	2	3	4
A_					
1			1st Div.	2nd Div.	3rd Div.
2	9th Div.	10th Div.	11th Div.	12th Div.	13th Div.
3	19th Div.	20th Div.	21st Div.	22nd Div.	23rd Div.
4	29th Div.	30th Div.	31st Div.	32nd Div.	33rd Div.
5	39th Div.	40th Div.	41st Div.	42nd Div.	43rd Div.
6	50th Div.	1st Flight Academy	2nd Flight Academy	3rd Flight Academy	4th Flight Academy
7					
8	1st Naval Div.	2nd Naval Div.	3rd Naval Div.	4th Naval Div.	5th Naval Div.



▶ **Chengdu J-7 II '81194 Red' is operated by the 9th Naval Division/25th Regiment based at Lingshui.**

▲▶ **J-7 IIAs '11440 Red' and '11442 Red' supposedly operated by the PLAAF's 3rd Division/7th Regiment at Wuhu, Nanjing Military Region, are in fact decoys, as revealed by the very crude landing gear, the odd shape of the canopy, the downward-angled pitot and the strongly cambered outer wings (for quick identification by own forces!).**

All photos via Internet

er) decoding system after June 2005				
6	7	8	9	0
5th Div	6th Div.	7th Div.	8th Div.	9th Div.
25th Div.	26th Div.	27th Div.	28th Div.	29th Div.
15th Div.	16th Div.	17th Div.	18th Div.	19th Div.
45th Div.	46th Div.	47th Div.	48th Div.	49th Div.
35th Div	36th Div.	37th Div.	38th Div.	39th Div.
6th Flight Academy	7th Flight Academy	8th Flight Academy	9th Flight Academy	
FT&TC	12th Flt Academy	13th Flt Academy	Navigator School	50th Div.
6th Naval Div.	7th Naval Div.	8th Naval Div.	9th Naval Div.	10th Naval Div.

ber) decoding system pre-June 2005				
5	6	7	8	9
4th Div.	5th Div.	6th Div.	7th Div.	8th Div.
14th Div.	15th Div.	16th Div.	17th Div.	18th Div.
24th Div.	25th Div.	26th Div.	27th Div.	28th Div.
34th Div.	35th Div	36th Div.	37th Div.	38th Div.
44th Div.	45th Div.	46th Div.	47th Div.	48th Div.
5th Flight Academy	6th Flight Academy	7th Flight Academy	8th Flight Academy	9th Flight Academy
	FT&TC	12th Flt Academy	13th Flt Academy	Navig. School
6th Naval Div.	7th Naval Div.	8th Naval Div.	9th Naval Div.	10th Naval Div.

and the number (1, 2 or 3) of the regiment within the division is denoted by B. Please note this is not the real number of the regiment which is calculated as shown above; presumably this system was devised to limit the total number of digits used for each aircraft to five. C and E indicate the number of the aircraft within the regiment. Obviously an aircraft's tactical code changes on moving to another regiment or division.

Known PLAAF J-7s (Shenyang-built)

Tactical code	Version	C/n	Comments
0002 Red	Shenyang J-7	?	Prototype; parabrake under fuselage, no fairing under rudder
0003 Red	Shenyang J-7	10003	Preserved PLAAF Museum; parabrake under fuselage, no fairing under rudder
1607 Red	Shenyang J-7	?	Parabrake under fuselage, no fairing under rudder

Known PLAAF J-7s (Chengdu-built)

Tactical code	Version	C/n	Unit	Comments
11244 Red	Chengdu J-7 (late)	714611	3rd Div.	Parabrake at base of rudder, preserved PLAAF Museum, Xiaotangshan (formerly Datang Shan)
11343 Red	Chengdu J-7 (late)	2014	3rd Div.	Parabrake at base of rudder, preserved PLAAF Museum
11447 Red	Chengdu J-7 (late)	714619	3rd Div.	Parabrake at base of rudder, sand/brown camouflage, preserved PLAAF Museum
71065 Red	Chengdu J-7	?	FT&TC	Parabrake under fuselage, small fairing under rudder
71066 Red	Chengdu J-7	?	FT&TC	Parabrake under fuselage, small fairing under rudder
71068 Red	Chengdu J-7	?	FT&TC	Parabrake under fuselage, small fairing under rudder
71069 Red	Chengdu J-7	?	FT&TC	Parabrake under fuselage, small fairing under rudder
81798 Red	Chengdu J-7	?	9th Naval Div.	Parabrake under fuselage, small fairing under rudder
89119 Red	Chengdu J-7 (late)	?	1st Naval Div.	Parabrake at base of rudder, preserved Revolutionary Museum, Beijing later replaced by J-7 I 31130 Red
98071 Red	Chengdu J-7 (late)	?	?	Parabrake at base of rudder, preserved PLAAF Museum (with fake tactical code?)

Known PLAAF and PLANAF J-7 I aircraft

Tactical code	Version	C/n	Unit	Comments
016	Chengdu J-7 I	?	3rd Flight Test Regiment, CAC	Preserved Northwest China University Museum
040	Chengdu J-7 I	?	CFTE	Central Flight Test Establishment, Xian-Yanliang
041	Chengdu J-7 I	?	CFTE	
042	Chengdu J-7 I	?	CFTE	
043	Chengdu J-7 I	?	CFTE	Preserved Seongmu, South Korea
044	Chengdu J-7 I	?	CFTE	
11181 Red	Chengdu J-7 I	?	7th Div.	
11182 Red	Chengdu J-7 I	?	7th Div.	
11183 Red	Chengdu J-7 I	?	7th Div.	
11184 Red	Chengdu J-7 I	?	7th Div.	
11185 Red	Chengdu J-7 I	?	7th Div.	
11186 Red	Chengdu J-7 I	?	7th Div.	
11187 Red	Chengdu J-7 I	?	7th Div.	
11188 Red	Chengdu J-7 I	?	7th Div.	
11189 Red	Chengdu J-7 I	?	7th Div.	
11286	Chengdu J-7 I	?	7th Div.	
11287	Chengdu J-7 I	?	7th Div.	Preserved PLAAF Museum but not noted recently
12284	Chengdu J-7 I	70705	7th Div.	Preserved PLAAF Museum
12381 Red	Chengdu J-7 I	70703	7th Div.	Preserved PLAAF Museum
12701 Black	Chengdu J-7 I	?	9th Div.	Converted to drone, white/orange/green colours
12702 Black	Chengdu J-7 I	?	9th Div.	Converted to drone, white/orange/green colours
13048	Chengdu J-7 I	?	3rd Div./9th Reg	
13049 Red	Chengdu J-7 I?	?	3rd Div./9th Reg	
13148 Red	Chengdu J-7 I?	?	3rd Div./9th Reg	
13441 Red	Chengdu J-7 I	?	3rd Div./9th Reg	
13443 Red	Chengdu J-7 I	?	3rd Div./9th Reg	
13125	Chengdu J-7 I	?	1st Div./3rd Reg.	
13223	Chengdu J-7 I	?	1st Div./3rd Reg.	
13444	Chengdu J-7 I	?	3rd Div./9th Reg	
13449	Chengdu J-7 I	?	3rd Div./9th Reg	
31130 Red	Chengdu J-7 I	?	12th Div.	Preserved Revolutionary Museum, Beijing, replaced 89119 Red
45035 Red	Chengdu J-7 I	?	42nd Div.	
45131 Red	Chengdu J-7 I	?	42nd Div.	
45134	Chengdu J-7 I	?	42nd Div.	
45135	Chengdu J-7 I	?	42nd Div.	
45136	Chengdu J-7 I	?	42nd Div.	
45137	Chengdu J-7 I	?	42nd Div.	
45232	Chengdu J-7 I	?	42nd Div.	
45239	Chengdu J-7 I	?	42nd Div.	
66117 White	Chengdu J-7 I	?	1st Flight Academy	Two-tone blue camouflage, preserved Chengdu
70162 Red	Chengdu J-7 I	?	Flight Test & Training Centre	Preserved PLAAF Museum
81399 Red	Chengdu J-7 I	?	9th Naval Div.	
83456	Chengdu J-7 I	?	5th Naval Div./15th Reg.	
83552	Chengdu J-7 I	?	5th Naval Div./15th Reg.	

Known PLAAF and PLANAF J-7 I (mod) aircraft

Tactical code	Version	C/n	Comments
3487 Red	Chengdu J-7 I (mod)	70004	Type 2 ejection seat and modified canopy, three-tone blue/white camouflage, preserved PLAAF Museum
9957 Red	Chengdu J-7 I (mod)	?	Type 2 ejection seat and modified canopy, preserved Park of National Defence

Known PLAAF and PLANAF J-7 II aircraft

Tactical code	Version	C/n	Unit	Comments
CAC 0134	Chengdu F-7II	?	Chengdu Aircraft Corp.	White/red/black demonstrator colours
CAC 0138	Chengdu F-7II	?	Chengdu Aircraft Corp.	White/red/black demonstrator colours. Became, see next line
950138 Red		?	Chengdu Aircraft Corp.	Dark green/dark earth camouflage
CAC 0141	Chengdu F-7II	?	Chengdu Aircraft Corp.	White/red/black demonstrator colours. Converted to F-7 IIA
3157	Chengdu J-7 II	?	Special Missile Test Unit (SMTU)	
3167	Chengdu J-7 II	?	SMTU	
10576	Chengdu J-7 II	?	6th Div.	
11004	Chengdu J-7 II	?	9th Div./25th Reg.	Post-2005 serial
11005	Chengdu J-7 II	?	9th Div./25th Reg.	Post-2005 serial
11025	Chengdu J-7 II	?	1st Div./1st Reg.	
11082 Red	Chengdu J-7 II	?	7th Div.	
11100	Chengdu J-7 II	?	7th Div.	
11124	Chengdu J-7 II	?	1st Div./1st Reg.	
11225	Chengdu J-7 II	?	1st Div./1st Reg.	
11226	Chengdu J-7 II	?	1st Div./1st Reg.	
11127	Chengdu J-7 II	?	1st Div./1st Reg.	
11189 Red?	Chengdu J-7 II	?	7th Div.	
11228	Chengdu J-7 II	?	1st Div./1st Reg.	
11280 Red	Chengdu J-7 II	?	7th Div.	
11301 Red	Chengdu J-7 II	?	9th Div./25th Reg.	
11302 Red	Chengdu J-7 II	?	9th Div./25th Reg.	
11303 Red	Chengdu J-7 II	?	9th Div./25th Reg.	
11304 Red	Chengdu J-7 II	?	9th Div./25th Reg.	
11305	Chengdu J-7 II	?	9th Div./25th Reg.	
11306	Chengdu J-7 II	?	9th Div./25th Reg.	
11307	Chengdu J-7 II	?	9th Div./25th Reg.	
11308 Red	Chengdu J-7 II	?	9th Div./25th Reg.	
11309 Red	Chengdu J-7 II	?	9th Div./25th Reg.	
11341	Chengdu J-7 II	?	3rd Div./7th Reg.	
11343	Chengdu J-7 II	2014	3rd Div./7th Reg.	Preserved PLAAF Museum
11400 Red	Chengdu J-7 II	7II 1015?	9th Div./25th Reg.	
13548	Chengdu J-7 II	?	3rd Div./9th Reg.	
13549	Chengdu J-7 II	?	3rd Div./9th Reg.	
13641	Chengdu J-7 II	?	3rd Div./9th Reg.	
13845	Chengdu J-7 II	?	3rd Div./9th Reg.	
14138 Red	Chengdu J-7 II	?	2nd Div./4th Reg.	
20085	Chengdu J-7 II	?	27th Div./Training Base Guangzhou	
20089 Red	Chengdu J-7 II	?	27th Div./Training Base Guangzhou	
20181	Chengdu J-7 II	?	27th Div./Training Base Guangzhou	
20183	Chengdu J-7 II	?	27th Div./Training Base Guangzhou	
20626	Chengdu J-7 II	?	21st Div.	
20755	Chengdu J-7 II	?	14th Div.	
20821	Chengdu J-7 II	?	21st Div.	
20824	Chengdu J-7 II	?	21st Div.	
20826	Chengdu J-7 II	?	21st Div.	
20851	Chengdu J-7 II	?	14th Div.	
20856	Chengdu J-7 II	?	14th Div.	
20921	Chengdu J-7 II	?	21st Div.	
20926	Chengdu J-7 II	?	21st Div.	
20927	Chengdu J-7 II	?	21st Div.	
20928	Chengdu J-7 II	?	21st Div.	
20929	Chengdu J-7 II	?	21st Div.	

21020	Chengdu J-7 II	?	21st Div.	
21022	Chengdu J-7 II	?	21st Div.	
21023	Chengdu J-7 II	?	21st Div.	
21130	Chengdu J-7 II	?	12th Div./35th Reg.	Post 6-2005 serial
21132	Chengdu J-7 II	?	12th Div./35th Reg.	Post 6-2005 serial
26200	Chengdu J-7 II	?	29th Div.	
26207	Chengdu J-7 II	?	29th Div.	
30603 Red	Chengdu J-7 II	?	19th Div./55th Reg.	
30682	Chengdu J-7 II	?	17th Div.	
30696	Chengdu J-7 II	?	28th Div.	
30703	Chengdu J-7 II	?	19th Div./55th Reg.	
30708	Chengdu J-7 II	?	19th Div./55th Reg.	
31134	Chengdu J-7 II	?	12th Div./35th Reg.	
31355	Chengdu J-7 II	?	14th Div./40th Reg.	
31392	Chengdu J-7 II	?	18th Div.	
31393	Chengdu J-7 II	?	18th Div.	
31397	Chengdu J-7 II	?	18th Div.	
31398	Chengdu J-7 II	?	18th Div.	
31491	Chengdu J-7 II	?	18th Div.	
31494	Chengdu J-7 II	?	18th Div.	
31531	Chengdu J-7 II	?	12th Div./35th Reg.	
31593	Chengdu J-7 II	?	18th Div.	
31693	Chengdu J-7 II	?	18th Div.	
31697	Chengdu J-7 II	?	18th Div.	
34795	Chengdu J-7 II	?	18th Div.	
40350	Chengdu J-7 II	?	44th Div.	
40353 Red	Chengdu J-7 II	?	44th Div.	
40355 Red	Chengdu J-7 II	?	44th Div.	
40357 Red	Chengdu J-7 II	?	44th Div.	
40359	Chengdu J-7 II	?	44th Div.	
40450 Red	Chengdu J-7 II	?	44th Div.	
40451	Chengdu J-7 II	?	44th Div.	
40452	Chengdu J-7 II	?	44th Div.	
40453	Chengdu J-7 II	?	44th Div.	
40454	Chengdu J-7 II	?	44th Div.	
40550 Red	Chengdu J-7 II	?	44th Div.	
40551	Chengdu J-7 II	?	44th Div.	
40552	Chengdu J-7 II	?	44th Div.	
40553	Chengdu J-7 II	?	44th Div.	
40554	Chengdu J-7 II	?	44th Div.	
45038	Chengdu J-7 II	?	42nd Div.	
45232 Red	Chengdu J-7 II	?	42nd Div.	
45239	Chengdu J-7 II	?	42nd Div.	
45437 Red	Chengdu J-7 II	?	42nd Div.	
50031	Chengdu J-7 II	?	32nd Div.	
50033	Chengdu J-7 II	?	32nd Div.	
50043	Chengdu J-7 II	?	33rd Div.	
50083	Chengdu J-7 II	?	37th Div.	
50136	Chengdu J-7 II	?	32nd Div.	
50189	Chengdu J-7 II	?	37th Div.	
50147	Chengdu J-7 II	?	33rd Div.	
50148	Chengdu J-7 II	?	33rd Div.	
50240	Chengdu J-7 II	?	33rd Div.	
50521	Chengdu J-7 II	?	31st Div.	
50622 Red	Chengdu J-7 II	?	31st Div.	Crashed, date unknown
50623	Chengdu J-7 II	?	31st Div.	
51067	Chengdu J-7 II	?	35th Div./103rd Reg.	

61028	Chengdu J-7 II	?	2nd Flt Academy	
81040 Red	Chengdu J-7 II	?	4th Naval Div./10th Reg.	
81041 Red	Chengdu J-7 II	?	4th Naval Div./10th Reg.	
81042 Red	Chengdu J-7 II	?	4th Naval Div./10th Reg.	
81043 Red	Chengdu J-7 II	?	4th Naval Div./10th Reg.	Also reported as a Chengdu J-7EH!
81044 Red	Chengdu J-7 II	?	4th Naval Div./10th Reg.	Also reported as a Chengdu J-7EH!
81145 Red	Chengdu J-7 II	?	4th Naval Div./10th Reg.	Also reported as a Chengdu J-7EH!
81148 Red	Chengdu J-7 II	?	4th Naval Div./10th Reg.	Also reported as a Chengdu J-7EH!
81149	Chengdu J-7 II	?	4th Naval Div./10th Reg.	
81191 Red	Chengdu J-7 II	?	9th Naval Div./25th Reg.	
81192 Red	Chengdu J-7 II	?	9th Naval Div./25th Reg.	
81194 Red	Chengdu J-7 II	?	9th Naval Div./25th Reg.	
81196 Red	Chengdu J-7 II	?	9th Naval Div./25th Reg.	
81240	Chengdu J-7 II	?	4th Naval Div./10th Reg.	
81243	Chengdu J-7 II	?	4th Naval Div./10th Reg.	
81341	Chengdu J-7 II	?	4th Naval Div./10th Reg.	
81397 Red?	Chengdu J-7 II	?	9th Naval Div./25th Reg.	Serial may be 81297 Red
81890	Chengdu J-7 II	?	9th Naval Div./25th Reg.	Preserved Qingdao Marine Museum
83081 Red	Chengdu J-7 II	?	8th Naval Div./24th Reg.	
83086 Red	Chengdu J-7 II	?	8th Naval Div./24th Reg.	
83093	Chengdu J-7 II	?	9th Naval Div./27th Reg.	
83097	Chengdu J-7 II	?	9th Naval Div./27th Reg.	
83185 Red	Chengdu J-7 II	?	8th Naval Div./24th Reg.	
83285	Chengdu J-7 II	?	8th Naval Div./24th Reg.	
83289	Chengdu J-7 II	?	8th Naval Div./24th Reg.	
83380	Chengdu J-7 II	?	8th Naval Div./24th Reg.	
83384	Chengdu J-7 II	?	8th Naval Div./24th Reg.	
83456	Chengdu J-7 II	?	5th Naval Div./15th Reg.	
83552	Chengdu J-7 II	?	5th Naval Div./15th Reg.	

The tables on pages 482-3 can be used to determine the divisional number from the tactical code. They include the PLAAF's 13 Flight Academies and the Flight Test & Training Centre (FT&TC). For example, an aircraft carrying the code 3xx6x belongs to the 15th Air Division.

The exceptions mentioned above are the four-digit and six-digit codes used for special test or reconnaissance units and the two- and three-digit codes assigned to prototypes and aircraft under test.

In June 2005 the system was changed for security reasons while retaining the same five-digit format so that an aircraft of the 15th Division will from June 2005 carry a code of the form 2xx6x. Some aircraft on display in museums carry spurious tactical codes that don't fit the system – but museums are notorious for that.

Some aircraft carry 0 as the second digit in the five-digit tactical codes. Its significance is not known but a reasonable conclusion is that an aircraft with it is not attached to any particular regiment in the division and is controlled directly by that division.

The codes of the aircraft listed in this section are in the pre-June 2005 system unless otherwise stated.

in March 1961 the Chinese government obtained a licence to build the MiG-21F-13 fighter, its R11F-300 engine and the R-3S missile, and three complete aircraft and 20 CKD kits were obtained from the USSR in May 1962. The kits were assembled at the Shenyang

Known PLAAF and PLANAF J-7 IIHs

Tactical code	Version	Unit//
3147 Red	Chengdu J-7 IIH	SMTU
30555 Red	Chengdu J-7 IIH	14th Div.
30751 Red	Chengdu J-7 IIH	14th Div.
30755	Chengdu J-7 IIH	14th Div.
45434	Chengdu J-7 IIH	42nd Div.
51368 Red	Chengdu J-7 IIH	35th Div./103rd Reg.
81196	Chengdu J-7 IIH	9th Naval Div./25th Reg.

Known Chinese J-7 IIA (F-7 IIA) aircraft

Tactical code	Version	Unit	Comments
CAC 0141	Chengdu F-7 IIA	CAC	Prototype F-7 IIA, J-7 IIA; see next line
950141 Red			Green/tan camouflage; same aircraft? See also F-7M
71169 Red	Chengdu J-7 IIA	FT&TC	

Known PLAAF and PLANAF J-7M (F-7M) aircraft

Tactical code	Version	Unit	Comments
11322	Chengdu J-7M	1st Div./1st Reg.	
11323	Chengdu J-7M	1st Div./1st Reg.	
11325	Chengdu J-7M	1st Div./1st Reg.	
11326	Chengdu J-7M	1st Div./1st Reg.	
21153	Chengdu J-7M	24th Div.	
31350	Chengdu J-7M	14th Div.	
31351	Chengdu J-7M	14th Div.	
31353	Chengdu J-7M	14th Div.	
31355	Chengdu J-7M	14th Div.	
31357	Chengdu J-7M	14th Div.	
31492	Chengdu J-7M	18th Div.	
31494	Chengdu J-7M	18th Div.	
31495	Chengdu J-7M	18th Div.	
84134 White	Chengdu F-7M	Chengdu Acft Corp.	Trials aircraft, green/brown/sand camouflage
84236	Chengdu J-7M	3rd Naval Div.	
84237	Chengdu J-7M	3rd Naval Div.	
86139	Chengdu F-7M	Chengdu Acft Corp.	Trials aircraft, green/brown/sand camouflage. Probably became, see next line
CAC 0139	Chengdu F-7M	Chengdu Acft Corp.	Trials aircraft, green/brown/sand camouflage
86140 Black	Chengdu F-7M	Chengdu Acft Corp.	Trials aircraft, green/brown/sand camouflage; see next line
89140 Black	Chengdu F-7M	Chengdu Acft Corp.	Trials aircraft, green/brown/sand camouflage; possibly ex 86140 Black!
950140 Red	Chengdu F-7M	Chengdu Acft Corp.	Trials aircraft, green/ sand camouflage; possibly same aircraft as previous two lines!
CAC 0141	Chengdu F-7M	Chengdu Acft Corp.	Trials aircraft, green/brown/sand camouflage

Factory No.112 and initially given PLAAF serials 1601-1620. One of these, now with nose number 98071 and Soviet construction number 741623, was preserved at the PLAAF Museum at Datang Shan but has not been noted recently.

The Chinese claimed, strongly denied by the Soviets, that deliberate errors had been included into the technical information and documentation supplied for MiG-21 production. Whatever the truth of the matter, the factory started to reverse-engineer the product then known as Type 62 but later designated Shenyang J-7 (*Jianjiji*, fighter aircraft). The first flight of a J-7 entirely manufactured in China took place on 17th January 1965, the aircraft carrying no tactical code. The second prototype had the code '0002 Red'. Only about 12 J-7 production aircraft as distict from prototypes were built at Shenyang before the line was transferred to Chengdu. The Chinese aircraft differed from its Soviet counterpart in having a fixed air intake shock cone and was not yet able to use air-to-air missiles as none were available.

The Shenyang J-7 *sans suffixe* is characterised by the parabrake being located under the fuselage, MiG-21F style.

Later in 1965 a decision was taken to transfer production to Factory No.132 at Chengdu (subsequently renamed Chengdu Aircraft Industry Corporation, CAC) but the move got caught up with the Cultural Revolution (1966-1970) and progress was very slow but, more importantly, the product quality was poor. Production tentatively began in June 1967 and the Chengdu J-7 *sans suffixe* fighter took to the air on 16th June 1969. The first examples differed from the Shenyang product in having a small fairing covering equipment at the fin/fuselage junction; subsequent production J-7s featured a much larger fairing beneath the rudder to hold the parabrake; the Russian equivalent fairing had a more pointed shape. All J-7s *sans suffixe* had one cannon on the starboard side. A small production run was utilised by the PLAAF and the PL-2 air-to-air missiles (R-3S copies) were carried when they became available.

A late-production Guizhou JJ-7 wearing the PLAAF's current grey low-visibility finish and a two-digit test code takes off. ▼

via Internet

Known PLAAF J-7 III (J-7C) aircraft

Tactical code	Version	C/n	Unit	Comments
150 Red	MiG-21MF	?	Chengdu Aircraft Corp.	Grey c/s
151 Red	Chengdu J-7 III	?	Chengdu Aircraft Corp.	Grey c/s, later red/white demonstrator c/s. Became, see next line
950151 Red		?	Chengdu Aircraft Corp.	Red/white/blue demonstrator c/s, later green/sand camouflage
2318	Chengdu J-7 III	?		Preserved Kangshan, ROC
25001 Red	Chengdu J-7C	?	29th Div.	Grey c/s?
25002 Red	Chengdu J-7C	?	29th Div.	Grey c/s
25003 Red	Chengdu J-7C	?	29th Div.	Grey c/s
25004 Red	Chengdu J-7C	?	29th Div.	Grey c/s
25005 Red	Chengdu J-7C	?	29th Div.	Grey c/s
25006 Red	Chengdu J-7C	?	29th Div.	Grey c/s?
25101 Red	Chengdu J-7C	?	29th Div.	Grey c/s
25104 Red	Chengdu J-7C	?	29th Div.	Grey c/s
25105 Red	Chengdu J-7C	?	29th Div.	Grey c/s?
25107 Red	Chengdu J-7C	?	29th Div.	Grey c/s?
30061 Red	Chengdu J-7C	?	15th Div.	Green/sand camouflage
30062 Red	Chengdu J-7C	?	15th Div.	Green/sand camouflage
30063 Red	Chengdu J-7C	?	15th Div.	Green/sand camouflage
30064	Chengdu J-7C	?	15th Div.	
30065 Red	Chengdu J-7C	?	15th Div.	Green/sand camouflage
30066 Red	Chengdu J-7C	?	15th Div.	Green/sand camouflage
30067 Red	Chengdu J-7C	?	15th Div.	Green/sand camouflage
30068 Red	Chengdu J-7C	?	15th Div.	Green/sand camouflage
30160	Chengdu J-7C	?	15th Div.	
30161 Red	Chengdu J-7C	06 205	15th Div.	Green/sand camouflage
30162	Chengdu J-7C	?	15th Div.	
30163 Red	Chengdu J-7C	?	15th Div.	Green/sand camouflage
30164 Red	Chengdu J-7C	?	15th Div.	Green/sand camouflage
30165	Chengdu J-7C	?	15th Div.	
30166	Chengdu J-7C	?	15th Div.	
30167	Chengdu J-7C	?	15th Div.	
30168 Red	Chengdu J-7C	?	15th Div.	Grey c/s
30169 Red	Chengdu J-7C	?	15th Div.	Grey c/s
30260	Chengdu J-7C	?	15th Div.	
30261 Red	Chengdu J-7C		15th Div.	Grey c/s; also reported as a J-7 IV (J-7D)
31278	Chengdu J-7C	?	15th Div.	
80088 Red?	Chengdu J-7C	?		Green/sand camouflage; code from photo but possibly retouched!
80188 Red	Chengdu J-7C	?		Green/sand camouflage; code from photo but possibly retouched!
950158 Red	Chengdu J-7 III	?	Chengdu Aircraft Corp.	Green/sand camouflage

The slow development of the PL-2 missile persuaded the PLAAF to ask for a second Type 30-1 cannon to be fitted and at the same time a translating shock cone was introduced. The new variant was called Chengdu J-7 I (sometimes called J-7A in the West). By the end of 1971 only 60 J-7 Is had been built; they were given the nose numbers 1801-1860 at the time. Later they received three-, four- or five-digit tactical codes depending on their unit's type. Both J-7 *sans suffixe* and J-7 I variants had a one piece canopy hinged at the front.

Known J-7 IV (J-7D) aircraft

Tactical code	Version	Unit	Comments
401 Red	Chengdu J-7 IV	CFTE	Overall blue c/s
402 Red	Chengdu J-7 IV	CFTE	Dark green/sand camouflage
403 Red	Chengdu J-7 IV	CFTE	Sand camouflage
404 Red	Chengdu J-7 IV	CFTE	Dark green/sand/blue camouflage
950155 Red	Chengdu J-7D	CAC	Camouflaged, F-7IIIA tail titles
50156 White	Chengdu J-7D	CAC	Camouflaged

Known PLAAF J-7Es

Tactical code	Version	C/n	Unit
10051	Chengdu J-7E	?	4th Div./10th Reg.
10055 Red	Chengdu J-7E	?	4th Div./10th Reg.
10056 Red	Chengdu J-7E	?	4th Div./10th Reg.
10057 Red	Chengdu J-7E	?	4th Div./10th Reg.
10058 Red	Chengdu J-7E	?	4th Div./10th Reg.
10059 Red	Chengdu J-7E	?	4th Div./10th Reg.
10150 Red	Chengdu J-7E	?	4th Div./10th Reg.
10151	Chengdu J-7E	?	4th Div./10th Reg.
10152	Chengdu J-7E	?	4th Div./10th Reg.
10153	Chengdu J-7E	?	4th Div./10th Reg.
10155	Chengdu J-7E	?	4th Div./10th Reg.
10156	Chengdu J-7E	?	4th Div./10th Reg.
10158	Chengdu J-7E	?	4th Div./10th Reg.
10159 Red	Chengdu J-7E	?	4th Div./10th Reg.
10250	Chengdu J-7E	?	4th Div./10th Reg.
10257 Red	Chengdu J-7E	?	4th Div./10th Reg.
11245 Red	Chengdu J-7E	?	3rd Div. /7th Reg.
11442	Chengdu J-7E	?	3rd Div. /7th Reg.
12022 Red	Chengdu J-7E	?	1st Div./2nd Reg.
12023	Chengdu J-7E	?	1st Div./2nd Reg.
12025	Chengdu J-7E	?	1st Div./2nd Reg.
12121 Red	Chengdu J-7E	?	1st Div./2nd Reg.
12122 Red	Chengdu J-7E	?	1st Div./2nd Reg.
12128 Red	Chengdu J-7E	?	1st Div./2nd Reg.
12220	Chengdu J-7E	?	1st Div./2nd Reg.
12222	Chengdu J-7E	?	1st Div./2nd Reg.
12223 Red	Chengdu J-7E	?	1st Div./2nd Reg.
12224	Chengdu J-7E	?	1st Div./2nd Reg.
12225	Chengdu J-7E	?	1st Div./2nd Reg.
12226	Chengdu J-7E	?	1st Div./2nd Reg.
12227	Chengdu J-7E	?	1st Div./2nd Reg.
12228	Chengdu J-7E	7E 0322	1st Div./2nd Reg.
12320	Chengdu J-7E	?	1st Div./2nd Reg.
12322 Red	Chengdu J-7E	?	1st Div./2nd Reg.
12324	Chengdu J-7E	?	1st Div./2nd Reg.
15031	Chengdu J-7E	?	2nd Div./5th Reg.
15037 Red	Chengdu J-7E	?	2nd Div./5th Reg.
15135 Red	Chengdu J-7E	?	2nd Div./5th Reg.
15231 Red	Chengdu J-7E	?	2nd Div./5th Reg.
15233 Red	Chengdu J-7E	?	2nd Div./5th Reg.
15234 Red	Chengdu J-7E	?	2nd Div./5th Reg.
15235 Red	Chengdu J-7E	?	2nd Div./5th Reg.
15237 Red	Chengdu J-7E	?	2nd Div./5th Reg.
31350	Chengdu J-7E	?	14th Div./40th Reg.
31351	Chengdu J-7E	?	14th Div./40th Reg.
31353	Chengdu J-7E	?	14th Div./40th Reg.
31357	Chengdu J-7E	?	14th Div./40th Reg.
40514 Yellow *	Chengdu J-7E	?	20th Div.
50681 Red	Chengdu J-7E	?	37th Div.
50980	Chengdu J-7E	?	37th Div.
72261	Chengdu J-7E	?	FTTC 3rd Reg.
72361	Chengdu J-7E	?	FTTC 3rd Reg.
72263 Red †	Chengdu J-7E	?	FTTC 3rd Reg.
72266 Red	Chengdu J-7E	?	FTTC 3rd Reg.
72267	Chengdu J-7E	?	FTTC 3rd Reg.
72269	Chengdu J-7E	?	FTTC 3rd Reg.
95153 White ‡	Chengdu J-7E	?	Chengdu Aircraft Corp.
95154 Black §	Chengdu J-7E	?	Chengdu Aircraft Corp.

* Overall blue c/s
† Green/grey camouflage
‡ Grey/black demonstrator colours
§ Blue/red demonstrator colours

◀ **Brand-new J-7Es in primer finish await painting and delivery on the Chengdu factory apron.**

Any J-7 and J-7 I fighters that survived until the early 1990s were withdrawn from service and many were converted into unmanned target drones. For example, '12701 Black' and '12702 Black' are both in the 9th Air division.

The Chinese clone of the SK ejection seat on the J-7 I did not allow safe ejection at low

Known Chinese F-7MGs

Serial	Version	C/n	Comments
CAC 0142	Chengdu F-7MG	7MG1612	Chengdu Aircraft Corp. Converted F-7M (originally with pure delta wings, later refitted with double-delta wings and curved windshield). Two-tone grey camouflage, white serial, two cannons
CAC 0143	Chengdu F-7MG	?	Chengdu Aircraft Corp. Technology testbed, converted F-7M with pure delta wings. Two-tone grey camouflage, white serial, two cannons. Converted/repainted as F-7PG demonstrator
CAC 0144	Chengdu F-7MG	?	Chengdu Aircraft Corp. Two-tone grey camouflage, black serial, one cannon

The J-7EBs of the PLAAF 'August 1st' aerobatic team

Tactical code	Version	C/n	Unit	Comments
01 Red	Chengdu J-7EB	?	24th Div./81st Display Team	Red/white c/s. To 01 White when repainted in blue/white c/s
02 Red	Chengdu J-7EB	7EB0632	24th Div./81st Display Team	Red/white c/s. To 02 White when repainted in blue/white c/s
03 Red	Chengdu J-7EB	?	24th Div./81st Display Team	Red/white c/s. To 03 White when repainted in blue/white c/s
04 Red	Chengdu J-7EB	7EB0634?	24th Div./81st Display Team	Red/white c/s. To 04 White when repainted in blue/white c/s
05 Red	Chengdu J-7EB	7EB0701?	24th Div./81st Display Team	Red/white c/s. To 05 White when repainted in blue/white c/s
06 Red	Chengdu J-7EB	7EB0638?	24th Div./81st Display Team	Red/white c/s. To 06 White when repainted in blue/white c/s
07 Red	Chengdu J-7EB	7EB0633	24th Div./81st Display Team	Red/white c/s. To 07 White when repainted in blue/white c/s
08 Red	Chengdu J-7EB	7EB0630?	24th Div./81st Display Team	Red/white c/s. To 08 White when repainted in blue/white c/s
09 Red	Chengdu J-7EB	?	24th Div./81st Display Team	Red/white c/s. To 09 White when repainted in blue/white c/s
10 Red	Chengdu J-7EB	?	24th Div./81st Display Team	Red/white c/s. To 10 White when repainted in blue/white c/s
11 Red	Chengdu J-7EB	?	24th Div./81st Display Team	Red/white c/s. To 11 White when repainted in blue/white c/s
12 Red	Chengdu J-7EB	?	24th Div./81st Display Team	Red/white c/s. To 12 White when repainted in blue/white c/s

altitudes or low speeds, so at least two examples were fitted with the indigenous Type 2 cartridge-fired seat, which necessitated a more bulbous (but still forward-hinged) canopy to accommodate the larger headrest. Known as the Chengdu J-7 I (modified), the design was not put into production because a new two-piece rear-hinged canopy was developed.

Mao Tse-tung's Cultural Revolution removed key personnel in both the industry and the PLA, which in the 1970s were in a chaotic state. However, in October 1977 Deng Xiaoping announced that effort would not be squandered on a plethora of fighter prototypes; instead, the industry should concentrate on perfecting the J-7 I before going too far ahead with its successor. Equally importantly, only qualified people would now be used. A new indigenous Chinese development, the Chengdu J-7 II (or J-7B in the West) was the next variant to be mass produced for the PLAAF with a large parabrake fairing located at the base of the rudder, a more powerful WP-7B engine, two 30-mm cannons and a two-piece canopy hinged at the back rather than the front. The first flight was on 30th December 1978 and about 200 were built.

In March 1985 the prototype of an improved J-7 II flew for the first time; it had new versatile missile launch rails which could carry all the types of ordnance then in use, obviating the need to change them when switching, for example, from missiles to bombs. Furthermore, the new development had the ability to fire Chinese-built PL-8 IR-homing air-to-air missiles and other improvements were also included: for example, a longer-life turbojet and a more robust undercarriage. These changes were subsequently incorporated on the J-7 II production

Known PLANAF J-7EHs

Tactical code	Version	Unit	Comments
81041?	Chengdu J-7EH	4th Naval Div./10th Reg.	Also reported as a Chengdu J-7 II!
81043?	Chengdu J-7EH	4th Naval Div./10th Reg.	Also reported as a Chengdu J-7 II!
81044?	Chengdu J-7EH	4th Naval Div./10th Reg.	Also reported as a Chengdu J-7 II!
81046	Chengdu J-7EH	4th Naval Div./10th Reg.	
81047 Red	Chengdu J-7EH	4th Naval Div./10th Reg.	
81048 Red	Chengdu J-7EH	4th Naval Div./10th Reg.	Also reported in error as a Chengdu J-7 II!
81143 Red	Chengdu J-7EH	4th Naval Div./10th Reg.	Also reported in error as a Chengdu J-7 II!
81144	Chengdu J-7EH	4th Naval Div./10th Reg.	
81145?	Chengdu J-7EH	4th Naval Div./10th Reg.	Also reported as a Chengdu J-7 II!
81148?	Chengdu J-7EH	4th Naval Div./10th Reg.	Also reported as a Chengdu J-7 II!
81241 Red	Chengdu J-7EH	4th Naval Div./10th Reg.	
81242 Red	Chengdu J-7EH	4th Naval Div./10th Reg.	
81244	Chengdu J-7EH	4th Naval Div./10th Reg.	
81246	Chengdu J-7EH	4th Naval Div./10th Reg.	
83041	Chengdu J-7EH	4th Naval Div./10th Reg.	
83043 Red	Chengdu J-7EH	4th Naval Div./10th Reg.	
83144	Chengdu J-7EH	4th Naval Div./10th Reg.	
83147	Chengdu J-7EH	4th Naval Div./10th Reg.	
83148	Chengdu J-7EH	4th Naval Div./10th Reg.	
83149	Chengdu J-7EH	4th Naval Div./10th Reg.	

Known PLAAF J-7Gs

Tactical code	Version	Unit	Comments
20137 Yellow	Chengdu J-7G	12th Div./34th Reg.	Overall blue c/s
50586 Red	Chengdu J-7G	37th Div./109th Reg.	
50680 Red	Chengdu J-7G	37th Div./109th Reg.	
50681 Red	Chengdu J-7G	37th Div./109th Reg.	
50686 Red	Chengdu J-7G	37th Div./109th Reg.	
95832 Red	Chengdu J-7G	Chengdu Aircraft Corp.	Test aircraft
95833 Red	Chengdu J-7G	Chengdu Aircraft Corp.	Test aircraft

Known PLAAF and PLANAF JJ-7 trainers

Tactical code	Version	Unit	Comments
13 Yellow	Guizhou JJ-7		No periscope
14 Yellow	Guizhou JJ-7		No periscope
411	Guizhou JJ-7	CFTE	
414 Red	Guizhou JJ-7	CFTE	White/blue/red demonstrator c/s
416 Red	Guizhou JJ-7	CFTE	Camouflaged
417	Guizhou JJ-7	CFTE	
10855	Guizhou JJ-7	4th Div.	
11043	Guizhou JJ-7	3rd Div./7th Reg.	
11044	Guizhou JJ-7	3rd Div./7th Reg.	
12422	Guizhou JJ-7	1st Div./2nd Reg.	
14731	Guizhou JJ-7	2nd Div./4th Reg.	
14732	Guizhou JJ-7	2nd Div./4th Reg.	
20101	Guizhou JJ-7	29th Div.	
20109	Guizhou JJ-7	27th Div.	
23222	Guizhou JJ-7	21st Div.	
23225 Red	Guizhou JJ-7	21st Div.	No periscope
31766 Red	Guizhou JJ-7		No periscope
40501	Guizhou JJ-7	29th Div.	
40502	Guizhou JJ-7	29th Div.	
50233	Guizhou JJ-7	32nd Div.	
50281	Guizhou JJ-7	37th Div.	
50282	Guizhou JJ-7	37th Div.	
50334	Guizhou JJ-7	32nd Div.	
50339	Guizhou JJ-7	32nd Div.	
50435	Guizhou JJ-7	32nd Div.	
50438	Guizhou JJ-7	32nd Div.	
50439	Guizhou JJ-7	32nd Div.	
50530	Guizhou JJ-7	32nd Div.	
50821	Guizhou JJ-7	31st Div.	
50822	Guizhou JJ-7	31st Div.	
51065	Guizhou JJ-7	35th Div.	
51281	Guizhou JJ-7	37th Div.	
51282	Guizhou JJ-7	37th Div.	
61363 Red	Guizhou JJ-7	6th Flt Academy	No periscope
71065	Guizhou JJ-7	FTTC 2nd Reg.	
71066	Guizhou JJ-7	FTTC 2nd Reg.	
71068	Guizhou JJ-7	FTTC 2nd Reg.	
71360 Red	Guizhou JJ-7	FTTC 2nd Reg.	
71363 Red?	Guizhou JJ-7	FTTC 2nd Reg.	
71364 Red	Guizhou JJ-7	FTTC 2nd Reg.	
71365 Red	Guizhou JJ-7	FTTC 2nd Reg.	
81943 Red	Guizhou JJ-7	4th Naval Div./10th Reg.	No periscope
83561 Red	Guizhou JJ-7	6th Naval Div./18th Reg.	
83961 Red	Guizhou JJ-7	6th Naval Div./18th Reg.	No periscope. Reported preserved

lines and the designation changed first to Chengdu J-7 IIH and was then abbreviated to Chengdu J-7H. 75 of this variant are reported to have been delivered.

An improved version of the J-7 II designated Chengdu J-7 IIA flew for the first time on 7th March 1984 as the F-7 IIA export variant; it had improved avionics and the nose probe was moved from the bottom to the top and offset to starboard. No official figures have been released of the number of J-7 IIs similarly converted but US sources suggest 225 in total, of which 180 were active in 2004.

Some J-7 IIs were brought up to F-7M Airguard standard in the 1980s and 1990s and designated Chengdu J-7M (sometimes referred to as the J-7 IIM). The main differences were the more efficient wings with four external stores hardpoints (the outer two were suitable for drop tanks), a better radar and the ability to use more modern missiles.

The Chinese government obtained six MiG-21MF (*izdeliye* 96F) all-weather multi-role fighters from Egypt and in due course CAC reverse-engineered a copy of this later Soviet development. The prototype flew on 26th April 1984 as the Chengdu J-7 III, later redesignated Chengdu J-7C. About 50 (some sources say 150!) were produced between 1985 and 1988. Due to their lack of BVR capability they were assigned to the ground attack role and received a special camouflage finish for this. Eventually some became night fighters in the 15th Air Division.

A specialised night fighter version of the J-7 III was designed and built in small quantities in the 1990s; about 50 were produced and designated Chengdu J-7D, at various times also referred to as the J-7 IV and J-7 IIIA.

The PLAAF preferred to develop the J-7 II rather than the J-7C, which was considered too unwieldy. Therefore the next production variant developed in 1987 featured a double-delta wing planform with leading- and trailing-edge flaps, the more powerful WP-13F turbojet, greater internal fuel capacity and the British-designed GEC-Marconi Super Skyranger radar. The changes resulted in a considerable improvement on the J-7 II in manoeuvrability and a substantial reduction in take-off and landing runs. As on the F-7M, J-7C and J-7D, four underwing pylons could be installed. Production of the Chengdu J-7E started in 1993 and stopped in 2002 after about 250 (some sources state 310!) had been assembled.

CAC operated several prototype examples of the J-7E's F-7MG export derivative.

An unarmed version of the J-7E equipped with a smoke generator was developed for the PLAAF's '*Ba Yi*' ('August 1st') aerobatic team and designated Chengdu J-7EB. In addition to the c/ns quoted on page 491, one of the team's aircraft had the c/n 7EB 0631 but its tactical code is not known.

A naval version of the J-7E known as the Chengdu J-7EH was developed for the PLANAF. Anti-shipping missiles such as the C-802 could be carried but the fighter's own radar was not sophisticated enough to allow an independent attack and after the missile had been launched its targeting data had to be supplied by other types of aircraft, such as the Harbin SH-5 flying boat or the Shaanxi Y-8X maritime patrol aircraft. One J-7EH (identity unknown) had the c/n 7EH0440.

A new development of the J-7E flew for the first time in 2002. Designated Chengdu J-7G, it had the new KLJ-6E ranging radar reputedly based on the Israeli Elta EL/M2001, a helmet-mounted sight for use with PL-8 air-to-air missiles and a more powerful turbojet; to compensate for extra weight one 30mm cannon was omitted. The prototype flew for the first time in June 2002 and production started in 2003, entering PLAAF in 2004. Sixteen were delivered to the 37th Air Division with codes in the 5xx8x series (4xx8x after June 2005) followed by 32 in November 2006 to the 12th Air Division with codes in the 2xx3x series.

An unarmed version of the J-7G replaced the J-7EB in the PLAAF's 'August 1st' aerobatic team and was designated Chengdu J-7GB. One of the team's aircraft had the c/n 7GB1006.

A two-seat combat trainer version of the J-7 was developed at the Guizhou Aviation Industry Group (GAIG). An example of the MiG-21UM (izd. 69) was received from Egypt in 1979 and reverse-engineered. First flown on 5th July 1985 production began in late 1987. The Guizhou JJ-7 bore a superficial resemblance to the MiG-21UM but there were several visual differences: the single ventral fin was replaced by twin canted strakes, the vertical tail had a different shape, an 800-litre centreline drop tank can be carried, redesigned and roomier canopies were fitted, and the saddle tank built into the fuselage spine was different. A twin-barrel 23mm cannon could be mounted under the fuselage and a PL-7 air-to-air missile could be carried under the wings.

After a short production run the JJ-7 was replaced on the assembly lines by the Guizhou JJ-7 I (or JJ-7A) with Chinese-designed ejection seats, and after an even shorter run the Chengdu JJ-7 II, with Rockwell Collins avionics, replaced the JJ-7 I. Most of the trainers that had already been built and survived were brought up to the latest standard. About 200 were built.

The www.sinodefence.com website suggests the existence of a Guizhou JJ-7P in the PLAAF with four underwing stores stations similar to the FT-7P of the Pakistani Air Force.

The J-7GBs of the PLAAF 'August 1st' aerobatic team

Tactical code	Version	Unit	Comments
01 White	Chengdu J-7GB	24th Div./81st Aerobatic Team	Blue/white Olympic promotional c/s with Beibei mascot
02 White	Chengdu J-7GB	24th Div./81st Aerobatic Team	Black/white Olympic promotional c/s with Jingjing mascot
03 White	Chengdu J-7GB	24th Div./81st Aerobatic Team	Red/white Olympic promotional c/s with Huanhuan mascot
04 White	Chengdu J-7GB	24th Div./81st Aerobatic Team	Yellow/white Olympic promotional c/s with Yingying mascot
05 White	Chengdu J-7GB	24th Div./81st Aerobatic Team	Green/white Olympic promotional c/s with Nini mascot
06 White	Chengdu J-7GB	24th Div./81st Aerobatic Team	Standard blue/white c/s
07 White	Chengdu J-7GB	24th Div./81st Aerobatic Team	Standard blue/white c/s
08 White	Chengdu J-7GB	24th Div./81st Aerobatic Team	Standard blue/white c/s
09 White	Chengdu J-7GB	24th Div./81st Aerobatic Team	Standard blue/white c/s
10 White	Chengdu J-7GB	24th Div./81st Aerobatic Team	Standard blue/white c/s
11 White	Chengdu J-7GB	24th Div./81st Aerobatic Team	Standard blue/white c/s
12 White	Chengdu J-7GB	24th Div./81st Aerobatic Team	Standard blue/white c/s

In 1994 there were reported to be 586 F-7 variants in service, by 2000 the number had risen to 740. By 2004 there were 1,575 in all, of which 345 were in reserve and 310 more set aside for spares, making 920 in active service.

Congo-Brazzaville

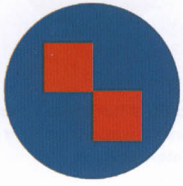
Confusingly there are two countries called Congo in Africa. The one dealt with here has the name of its capital appended to distinguish it from the Democratic Republic of Congo (alias Congo-Kinshasa) which from 1971 to 1997 was known as Zaïre and which never used MiG-21s. The air arm of Congo-Brazzaville is known as the *Force Aérienne Congolaise* (FAC) and was

Congolese Aircraft MiG-21*bis* fighters sit withdrawn from use at Pointe-Noire.
▼

via Internet

www.nicpix.nl

Known Congolese Air Force MiG-21s			
Serial	Version	C/n	Comments
501	MiG-21UM	?	
503	MiG-21UM	?	Noted 1997 Maya-Maya
505	MiG-21bis (izd. 75B)	?	
507	MiG-21bis (izd. 75B)	?	Noted 1997 Maya-Maya
509	MiG-21bis (izd. 75B)	75087309	Grey overall. Noted 1997 stored Pointe-Noire
511	MiG-21bis (izd. 75B)	75087406	Grey/green/brown camouflage. Noted 1997 stored Pointe-Noire
513	MiG-21bis (izd. 75B)	75087444	Grey/green/brown camouflage. Noted 1997 stored Pointe-Noire
515	MiG-21bis (izd. 75B)	75087458	Noted 1997 stored Pointe-Noire
517	MiG-21bis (izd. 75B)	?	Noted 1997 Maya-Maya
519	MiG-21bis (izd. 75B)	?	
521	MiG-21bis (izd. 75B)	?	Noted 1997 Maya-Maya
523	MiG-21bis (izd. 75B)	?	Noted 1997 Maya-Maya
525	MiG-21bis (izd. 75B)	75096461	Grey overall. Noted 1997 stored Pointe-Noire
527	MiG-21bis (izd. 75B)	?	
529	MiG-21UM	?	Crashed 11-10-1989
530	MiG-21UM	?	Noted 1997 Maya-Maya



formed in the early 1960s; for the first ten years of its existence it relied on French equipment before switching to Soviet aircraft. Two MiG-21UM (*izdeliye* 69A) trainers and one MiG-21*bis* (*izdeliye* 75B) arrived in 1988 and within two years the total was reported as five and 16 respectively. At least one squadron was commissioned in 1991, but in 1997 many of the MiGs were out of use stored in a hangar at Pointe-Noire; however, one (or possibly two) was used in the civil war that began that year.

Known examples are given below, for some unknown reason only odd numbers were used for the black serials of the fighters:

Croatia

Croatia declared its independence from Yugoslavia in June 1991. Several Independent Air Units (*Samostalni zrakoplovni vod*, SZV) with a total of 41 aircraft operated to support local units (HV) of the National Guard (*Zbor Narodne Garde*, ZNG) fighting the Yugoslav army. After the Yugoslav army withdrew from most of Croatia in 1992 the **Croatian Air Force** (CrAF) or *Hrvatsko ratno zrakoplovstvo i protuzračna obrana* (HRZ i PZO) was formed. The only fighter aircraft used so far by the CrAF is the MiG-21*bis* (*izdeliye* 75A and 75B) supported by MiG-21UM (*izdeliye* 69) trainers converted to the ground attack role.

While the fighting raged with Yugoslavia the three MiG-21bis that had defected were put into 1 *Eskadrila Lovačkih Zrakoplova* (Fighter Air Squadron, ELZ) of the Croatian Air Force, by then renamed *Hrvatske Zračne Snage* (HZS).

After the Dayton Peace Agreement was signed in November 1995 the CrAF was able to purchase 40 MiG-21*bis* and MiG-21UMs from the Ukraine; these arrived in crates, starting in 1994. The CrAF assembled 16 airworthy MiG-21*bis* and four MiG-21UMs and based these at Zagreb-Pleso and Pula. The remaining aircraft were stored for use as spares at the Zmaj (Dragon) overhaul and maintenance facility (ZTZ – *Zrakoplovni Tehnicki Zaklad*) in Velika Gorica, close by Pleso.

In 2003 the CrAF purchased from Aerostar in Romania eight MiG-21*bis* fighters that had been overhauled and given upgraded avionics for NATO interoperability. Such aircraft can be identified by the large ventral blade aerial offset to port just aft of the nose gear unit. They bear the unofficial local designation **MiG-21*bis*D**.

Marinus D. Tabak

At first the Croatian MiG-21*bis* fighters retained the ex-Yugoslav Air Force air superiority grey finish, wearing a YuAF-style fin flash and the Croatian chequered shield on the fuselage. The digits 167 visible on the starboard wing are not the Croatian serial (CrAF '167 Black' is a MiG-21UMD) but the last three of the former YuAF serial, 17167; the proper serial (not worn visibly) is 103.

Croatian Air Force MiG-21*bis* '103 White' *Osvetnik Vukovara* (Vukovar Avenger), 21 ELZ, shot down on 21st September 1993

These newly acquired aircraft did not give immediate satisfaction and were returned to Aerostar later that year to remedy the faults.

Croatian Air Force units operating the type were:

• 91 *Zrakoplovna Baza* (ZB – Air Base) at Zagreb-Pleso, with 21 ELZ, later known as 21 *Eskadrila Borbenih Aviona* (EBA – Air Combat Squadron) was formed from the original 1 ELZ adopting the same insignia – the helmet of the Black Knight with a shield bearing the Croatian national emblem;

• 92 ZB at Pula, with 22 ELZ

However, all airworthy MiG-21s are currently concentrated at Pula.

At first many CrAF aircraft did not carry visible individual identification, such as a serial. The national insignia were in the form of a Yugoslav

▲
The current badge of the Croatian Air Force (HZS).

Chris Lofting

◄
A line-up of Croatian MiG-21s at Pula AB. See also page 497.

Croatian Air Force pilots pose with a MiG-21*bis*D. Note the rakish 'pirate headdress' of the second man from the right.
▼

Chris Lofting

Chris Lofting

▲ **MiG-21bisD '117 Black' takes off in full afterburner, showing the current three-tone camouflage and the ventral blade aerial identifying this upgrade.**

Air Force-style full-chord red/white/blue fin flash and the elaborate Croatian crest on the fuselage. Later some aircraft had three-digit serials applied to the fuselage nose and the wings; the crest was moved to the fin and replaced on the fuselage by a blue roundel with red chequers.

A MiG-21U (*izdeliye* 66-400) was seen preserved at Zadar as '195' in 2006, although the serial is probably fake. Nothing is known of its service history with the CrAF and it is likely to have been abandoned by the Yugoslav Air Force (YuAF) during the wars that followed Croatia's

Croatian Air Force MiG-21bis '107', 1 ELZ, Zagreb-Pleso
Croatian Air Force MiG-21bis
1 ELZ, Zagreb-Pleso
Croatian Air Force MiG-21bis '120'
22 ELZ, Pula, August 2000

Chris Lofting

▲
The 'Black Knight' squadron badge of the 1. ELZ.

◄
MiG-21UMD '165 Black' received this striking overall red/white chequered colour scheme symbolising the Croatian national crest in 2005. The machine is dubbed *Kockica* (Chessboard) or *Vatreni* (after the national football team).

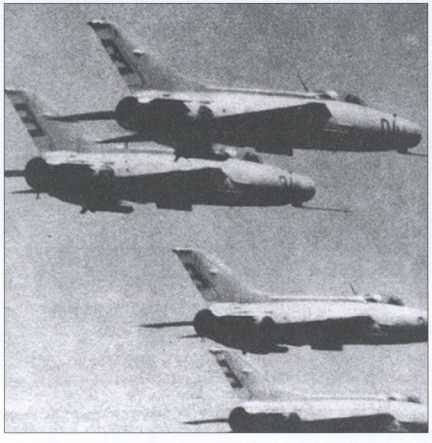
Croatian Air Force MiG-21*bis* fighters

Serial	Version	C/n	In service	First unit	Comments
101	MiG-21*bis*	75092119	4-1-92?	SZV	Ex-YuAF 17133, obtained 4-1-1992, 1 ELZ. Shot down 24-6-1992
102 Black	MiG-21*bis* (izd. 75A)	75092741	15-5-92	1 ELZ	Ex-YuAF 17235, named *Osvetnik Dubrovnika* (Dubrovnik Avenger), 23 ELZ. Overall grey c/s, knight's head nose art, serial '102 White' on tail; later green/grey camouflage, serial '102 Black' on nose. Noted 2006 stored Velika Gorica
103 White	MiG-21*bis* (izd. 75B)	75094051	15-5-92	1 ELZ	Ex-YuAF 17167, obtained 15-5-1992,named *Osvetnik Vukovara* (Vukovar Avenger), 21 ELZ; overall grey c/s, old insignia. Shot down 14-9-1993
104	MiG-21*bis*	?		21 ELZ	Green/grey/tan camouflage. Written off 16-4-1995
105	MiG-21*bis*	?		21 ELZ	Noted stored Pleso 2004
106	MiG-21*bis*	?			Noted stored Pleso 2004
107 Black	MiG-21*bis* (izd. 75A)	?			Green/brown camouflage. Noted stored Pleso 2004
108 Black	MiG-21*bis* (izd. 75A)	?	2003	22 ELZ	Three-tone green/grey camouflage. **Converted to MiG-21*bis*D**, bought from Aerostar
109	MiG-21*bis*	?		21 ELZ	Crashed 14-8-1995
110 Black	MiG-21*bis*	75017895	2003	22 ELZ	**Converted to MiG-21*bis*D**, bought from Aerostar
111	MiG-21*bis*	?			Noted 2006 withdrawn from use on the dump at Velika Gorica
112	MiG-21*bis*	?			Noted 2004 stored Velika Gorica
113 Black	MiG-21*bis* (izd. 75A)	?			Green/grey camouflage. Noted stored Pleso 2004
114	MiG-21*bis*	?			Withdrawn from use 2002, noted on the dump at Velika Gorica
115 Black	MiG-21*bis* (izd. 75A)	7500275...	2003	22 ELZ	Three-tone green/grey camouflage. **Converted to MiG-21*bis*D**, bought from Aerostar Was 115 White for a while
116 Black	MiG-21*bis* (izd. 75A	?	2003	22 ELZ	Three-tone green/grey camouflage. **Converted to MiG-21*bis*D**, bought from Aerostar Was 116 White for a while
117 Black	MiG-21*bis* (izd. 75A)	75092923	2003	22 ELZ	Three-tone green/grey camouflage. **Converted to MiG-21*bis*D**, bought from Aerostar
118	MiG-21*bis*	75092905			Noted stored Pleso 2004
119	MiG-21*bis*	?		21 ELZ	Shot down 2-5-1995
120 Black	MiG-21*bis* (izd. 75A)	75079157	2003	22 ELZ	Three-tone green/grey camouflage. **Converted to MiG-21*bis*D**, bought from Aerostar
121 Black	MiG-21*bis* (izd. 75B)	75021145	2003	22 ELZ	Three-tone green/grey camouflage. **Converted to MiG-21*bis*D**, bought from Aerostar
122 Black	MiG-21*bis* (izd. 75A)	?	2003	22 ELZ	Three-tone green/grey camouflage. **Converted to MiG-21*bis*D**, bought from Aerostar
123	MiG-21*bis*	?			Noted 2004 stored Velika Gorica
124 Black	MiG-21*bis* (izd. 75A)	?			Green/tan camouflage, knight's head nose art. Noted stored Pleso 2004
125 Black	MiG-21*bis* (izd. 75A)	?			Green/grey camouflage, knight's head nose art. Noted 2004 preserved Gornja Stubica
126	MiG-21*bis*	?			Noted 2004 stored Velika Gorica

Croatian Air Force MiG-21UMs			
Serial	**Version**	**C/n**	**Comments**
160 Black	MiG-21UM	?	Green/grey camouflage, knight's head nose art. Noted stored Zagreb-Pleso AB 2004
161 Black	MiG-21UM	?	Noted stored Zagreb-Pleso AB 2004 as 80 Yellow, by 2007 gate guard Pleso AB as 161
162	MiG-21UM	516999207	Noted 2004 stored Velika Gorica
163 Black	MiG-21UM		Green/brown camouflage. Noted 2004 stored Velika Gorica
164 Black	MiG-21UMD	516969001	Green/grey/brown camouflage, knight's head nose art. Purchased 2003 from Aerostar, 22 ELZ
165 Black	MiG-21UMD	516911036	Green/grey/brown camouflage; overall red/white chequered special c/s by 2005. Purchased 2003 from Aerostar, 22 ELZ
166 Black	MiG-21UMD	516951031	Green/grey/brown camouflage. Purchased 2003 from Aerostar, 22 ELZ
167 Black	MiG-21UMD	516987091	Green/grey/brown camouflage, knight's head nose art. Purchased 2003 from Aerostar, 22 ELZ

declaration of independence. Only three examples of this type served with the YuAF and one, serialled 22903, was noted at Zadar in 1999; this may be the aircraft in question.

The CrAF obtained four MiG-21UMs (*izdeliye* 69) either from abandoned YuAF stock or, more likely, from Ukrainian Air Force surplus stocks. In 2003, four more were purchased from Aerostar of Romania, after being upgraded to **MiG-21UMD** standard in a similar fashion to the eight MiG-21*bis*Ds. Stories have circulated that they are former Luftwaffe /East German Air Force aircraft but their c/ns do not match any German MiG-21UMs.



Cuba

Founded in 1915 (although not operational until 1919), the *Cuerpo de Aviación del Ejército de Cuba* (Aviation Corps of the Cuban Army) had developed from a *Cuerpo* to a *Fuerza* (Force) in 1955. After the Revolution led by Fidel Castro Ruz, the name was changed in 1959 to *Fuerza Aérea Revolucionaria* (FAR) and by 1972 it had equal standing with the Army and Navy. The next redesignation reflected a more defensive attitude and the *Defensa Anti-Aérea y Fuerza Aérea Revolucionaria* (DAAFAR) is still the official name of the Cuban Air Force.

The first MiG-21F-13 fighters to arrive in Cuba in 1962 belonged to the 213th IAP, PVO, USSR. This regiment, when based at Kubinka as the 32nd GvIAP, was the first in the USSR to receive the MiG-21F-13, becoming operational in 1961. Its designation was changed and it was secretly moved in June 1962 to a Baltic port and, together with its 40 fighters and six UTI MiG-15 trainers, transhipped to Cuba, arriving in September and taking up residence at Santa Clara. As a sensible precaution after the Cuban Missile Crisis started on 22nd October, its aircraft were prudently dispersed to San

All photos via Internet

▲◄
A flight of Cuban MiG-21F-13s with two-digit serials suggesting these are aircraft of the first batch delivered. Note that the Cuban flag occupies only a small portion of the rudder.

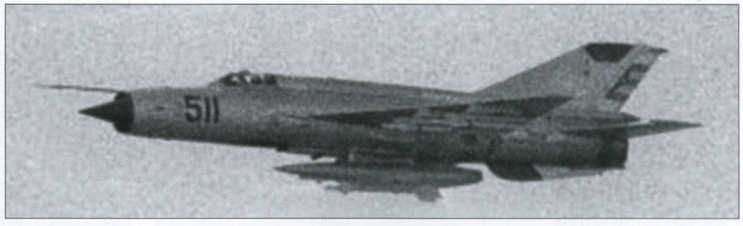
◄
Another Cuban Air Force MiG-21F-13, '437 Red', with the Cuban flag occupying the entire rudder.

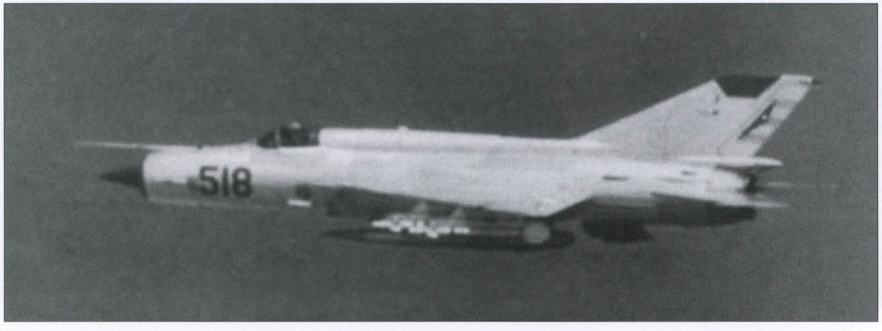
◄ **Camouflaged MiG-21F-13 '420 Red' is one of two preserved at the DAAFAR Museum in Havana.**

Antonio de los Baños, Santa Clara and Camagüey at the end of October. At first the fighters carried no national insignia but after a potentially perilous confrontation with two Lockheed F-104C Starfighters of the USAF's 479th Tactical Fighter Wing, FAR insignia were hastily added.

After the resolution of the Cuban Missile Crisis on 28th October 1962, the regimental staff returned to the USSR leaving behind their 46 aircraft (including two MiG-21U trainers), which

◄ **Routine maintenance of a Cuban MiG-21PFM – a late-production machine with a sideways-hinged canopy. Note the crudely applied flag on the rudder.**





◄▲ **Cuban Air Force MiG-21MFs '511 Red' and '518 Red' patrolling the Cuban airspace with a drop tank and four missiles.**

All photos via Internet

Known Cuban Air Force MiG-21F-13s

Serial	Version	C/n	In service date
01 Red	MiG-21F-13	?	8-1963
02 Red	MiG-21F-13	?	8-1963
03 Red	MiG-21F-13	?	8-1963
04 Red	MiG-21F-13	?	8-1963
05 Red	MiG-21F-13	?	8-1963
06 Red	MiG-21F-13	?	8-1963
07 Red	MiG-21F-13	?	8-1963
08 Red	MiG-21F-13	?	8-1963
09 Red	MiG-21F-13	?	8-1963
10 Red	MiG-21F-13	?	8-1963
11 Red	MiG-21F-13	?	8-1963
12 Red	MiG-21F-13	?	8-1963
13 Red	MiG-21F-13	?	8-1963
14 Red	MiG-21F-13	?	8-1963
15 Red	MiG-21F-13	?	8-1963
16 Red	MiG-21F-13	?	8-1963
17 Red	MiG-21F-13	?	8-1963
18 Red	MiG-21F-13	?	8-1963
19 Red	MiG-21F-13	?	8-1963
20 Red	MiG-21F-13	?	8-1963
21 Red	MiG-21F-13	?	8-1963
22 Red	MiG-21F-13	?	8-1963
23 Red	MiG-21F-13	?	8-1963
24 Red	MiG-21F-13	?	8-1963
25 Red	MiG-21F-13	?	8-1963
26 Red	MiG-21F-13	?	8-1963
27 Red	MiG-21F-13	?	8-1963
28 Red	MiG-21F-13	?	8-1963
29 Red	MiG-21F-13	?	8-1963
30 Red	MiG-21F-13	?	8-1963
31 Red	MiG-21F-13	?	8-1963
32 Red	MiG-21F-13	?	8-1963
33 Red	MiG-21F-13	?	8-1963
34 Red	MiG-21F-13	?	8-1963
35 Red	MiG-21F-13	?	8-1963
36 Red	MiG-21F-13	?	8-1963
37 Red	MiG-21F-13	?	8-1963
38 Red	MiG-21F-13	?	8-1963
39 Red	MiG-21F-13	?	8-1963
40 Red	MiG-21F-13	?	8-1963
41 Red	MiG-21F-13	?	8-1963
42 Red	MiG-21F-13	?	8-1963
43 Red	MiG-21F-13	?	8-1963
44 Red	MiG-21F-13	?	8-1963
67	MiG-21F-13	?	8-1963
411 Red *	MiG-21F-13	741405	
420 Red †	MiG-21F-13	?	
437 Red ‡	MiG-21F-13	?	
7000 §	MiG-21F-13	?	

* Grey/blue camouflage. Preserved DAAFAR Museum, Havana

† Two-tone green camouflage. Preserved DAAFAR Museum, Havana

‡ Silver overall, large Cuban flag on rudder

§ Preserved Sandino, spurious serial

Known Cuban Air Force MiG-21PFs and MiG-21PFMs

Serial	Version	C/n	Delivery date
361	MiG-21PFM	?	1966-7
362	MiG-21PFM	?	1966-7
363	MiG-21PFM	?	1966-7
364	MiG-21PFM	?	1966-7
365	MiG-21PFM	?	1966-7
366	MiG-21PFM	?	1966-7
367	MiG-21PFM	?	1966-7
368 Red	MiG-21PFM	?	1966-7
369	MiG-21PFM	?	1966-7
370	MiG-21PFM	?	1966-7
371	MiG-21PFM	?	1966-7
372	MiG-21PFM	?	1966-7
373	MiG-21PFM	?	1966-7
374	MiG-21PFM	?	1966-7
375	MiG-21PFM	?	1966-7
376	MiG-21PFM	?	1966-7
377	MiG-21PFM	?	1966-7
378	MiG-21PFM	?	1966-7
379	MiG-21PFM	?	1966-7
380	MiG-21PFM	?	1966-7
381	MiG-21PFM	?	1966-7
382	MiG-21PFM	?	1966-7
383	MiG-21PFM	?	1966-7
384	MiG-21PFM	?	1966-7
1006 Black *	MiG-21PF	761911	
1779 †	MiG-21PFM	?	

* Preserved DAAFAR Museum, Havana with fake serial

† Preserved San Antonio de los Baños AB with fake serial

were used in the formation of the first Cuban MiG-21F-13 regiment on 10th August 1963 at San Antonio de los Baños.

In FAR service the serial numbers 01 to 44 were used. It is possible but unlikely that more MiG-21F-13s were subsequently delivered; more probably, existing aircraft were reserialled.

The FAR received at least one squadron, and probably two, of MiG-21PF (*izdeliye* 76) interceptors in 1964 but no further details are

available, except that some Hungarian sources suggest that the Soviet PVO's 234th IAP (also from Kubinka AB) was based at San Antonio de los Baños for a while in October 1962, flying MiG-21PFs.

In 1966-67, the FAR took delivery of between 24 and 36 MiG-21PFMs (*izdeliye* 94A) with known red tactical numbers 361 to 384. The Cuban MiG-21PFMs were able to carry the GP-9 gun pack with its GSh-23 cannon under the fuselage and ultimately, if not when delivered, had four wing pylons. Two squadrons were formed at San Antonio de los Baños, displacing the MiG-21F-13s to Holguín. The MiG-21PFMs were, in turn, replaced in 1968 by MiG-21MFs. However, at UM 7000 *Escuela de Aviación Militar 'Comandante Ché Guevara'* (Military Flying School; UM = *Unidad Militar* – military unit) at Ciudad Libertad, the *Escuela de Enseñanza de Preparación Combativa* (Combat Training School), had a squadron of MiG-21PFMs, believed to be UM1650, which survived the school's disbanding. Any left intact have been withdrawn from use and stored. One MiG-21PF and one MiG-21PFM have been preserved with spurious four-digit serials.

Twelve examples of the MiG-21R (*izdeliye* 94RA) reconnaissance version arrived in 1968 and equipped a squadron. Known examples had black serials. This variant carried a reconnaissance pod on the centreline, two underwing drop tanks and two air-to-air missiles.

In all, 60 (?) MiG-21MFs (*izdeliye* 96F) were delivered to the FAR between 1972 and 1974, initially replacing two regiments of MiG-21PFMs. Two squadrons, each with twelve MiG-21MFs, were airlifted to Angola in 1975-76 to take part in the fighting there; it is possible (but doubtful) that some or all of them were part of the Cuban order noted above. There is some confusion because these aircraft were flown and serviced in Angola by FAR volunteers.

The FAR ultimately fielded two regiments of MiG-21MFs, which by 1990 were organised as follows:

Known Cuban Air Force MiG-21Rs

Serial	Version	Comments
103 Black	MiG-21R	Noted as withdrawn from use
104 Black	MiG-21R	Preserved as '460' in Parque Lenin, Havana
111 Black	MiG-21R	Grey/blue camouflage. Preserved DAAFAR Museum, Havana
11... Black	MiG-21R	Noted 2005 stored Bayamo

Known Cuban Air Force MiG-21MFs

Serial	Version	In service date	Comments
510 Red	MiG-21MF	1972-74	
511 Red	MiG-21MF	1972-74	Silver overall. Crashed 1979
512 Red	MiG-21MF	1972-74	
513 Red	MiG-21MF	1972-74	
514 Red	MiG-21MF	1972-74	
515 Red	MiG-21MF	1972-74	
516 Red	MiG-21MF	1972-74	
517 Red	MiG-21MF	1972-74	
518 Red	MiG-21MF	1972-74	Silver overall
519 Red	MiG-21MF	1972-74	Crashed 1981
520 Red	MiG-21MF	1972-74	
521 Red	MiG-21MF	1972-74	
522 Red	MiG-21MF	1972-74	
523 Red	MiG-21MF	1972-74	
542 Red	MiG-21MF	1972-74	
547 Red	MiG-21MF	1972-74	
772 Red	MiG-21MF		
780 Red	MiG-21MF		

1ª *Brigada de Guardia 'Batalla de Santa Clara'* of *Zona Aérea Central* had

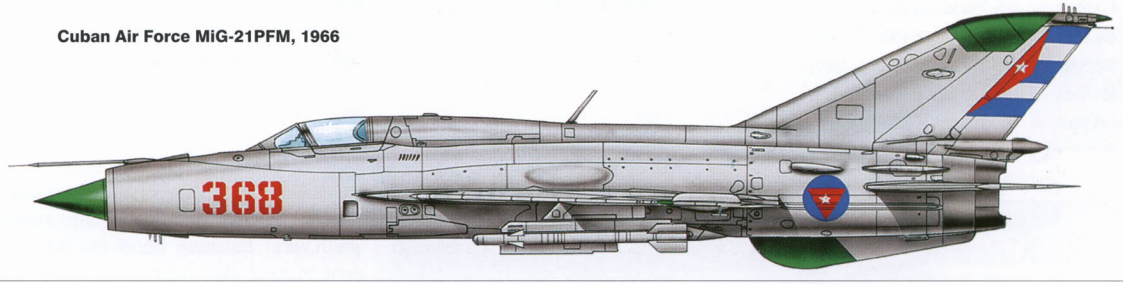
12° *Regimiento de Caza* (Fighter Regiment) at Sancti Spiritus with 121° and 122° *Escuadrones* (squadrons), each of which had 15 MiG-21MFs and MiG-21UMs

3ª *Brigada de Guardia 'Cuartel Moncada'* of *Zona Aérea Oriental* (the Eastern Air Zone)had

31° *Regimiento de Caza* at Camagüey with 311° and 312° *Escuadrones*, each of which had 15 MiG-21MFs and MiG-21UMs.

In 2007 the order of battle shows:

Cuban Air Force MiG-21PFM, 1966



Cuban Air Force MiG-21*bis* fighters

Serial	Version	Comments
600	MiG-21*bis*	
601	MiG-21*bis*	
602 Black	MiG-21*bis*	Camouflaged
603	MiG-21*bis*	
604	MiG-21*bis*	
605	MiG-21*bis*	
606	MiG-21*bis*	
607	MiG-21*bis*	
608	MiG-21*bis*	
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616	MiG-21*bis*	
617	MiG-21*bis*	
618	MiG-21*bis*	
619	MiG-21*bis*	
620	MiG-21*bis*	
621	MiG-21*bis*	
622	MiG-21*bis*	
623	MiG-21*bis*	
624	MiG-21*bis*	
625	MiG-21*bis*	
626	MiG-21*bis*	
627	MiG-21*bis*	
628	MiG-21*bis*	
629	MiG-21*bis*	
630	MiG-21*bis*	
631	MiG-21*bis*	
632	MiG-21*bis*	
633	MiG-21*bis*	
634	MiG-21*bis*	
635	MiG-21*bis*	
636	MiG-21*bis*	
637	MiG-21*bis*	Instructional airframe at *Instituto Tecnico Militar*
638	MiG-21*bis*	
639	MiG-21*bis*	
640	MiG-21*bis*	
641	MiG-21*bis*	
642	MiG-21*bis*	
643	MiG-21*bis*	
644	MiG-21*bis*	
645	MiG-21*bis*	
646	MiG-21*bis*	
647	MiG-21*bis*	
648	MiG-21*bis*	
649	MiG-21*bis*	
650	MiG-21*bis*	
651	MiG-21*bis*	
652	MiG-21*bis*	
653	MiG-21*bis*	
654	MiG-21*bis*	
655	MiG-21*bis*	
656 Black	MiG-21*bis*	Green/blue camouflage
657	MiG-21*bis*	
658	MiG-21*bis*	
659	MiG-21*bis*	
660	MiG-21*bis*	
661 Black	MiG-21*bis*	Four-tone green/brown camouflage?
662	MiG-21*bis*	
663	MiG-21*bis*	
664	MiG-21*bis*	
665 Black	MiG-21*bis*	Green/blue camouflage
666	MiG-21*bis*	
667	MiG-21*bis*	
668	MiG-21*bis*	
669	MiG-21*bis*	
670	MiG-21*bis*	
671	MiG-21*bis*	
672 Black	MiG-21*bis*	Grey/blue camouflage. Defected to Florida 17-9-1993

Cuban Air Force MiG-21U trainers

Serial	Version	Delivery date
401 Black	MiG-21U (*izd.* 66-600)	1966
402 Black	MiG-21U (*izd.* 66-600)	1966
403 Black	MiG-21U (*izd.* 66-600)	1966
404 Black	MiG-21U (*izd.* 66-600)	1966
405 Black	MiG-21U (*izd.* 66-600)	1966

Cuban Air Force MiG-21UMs

Serial	Version	C/n	Delivery date	Comments
500 Black	MiG-21UM	?	1968	Silver overall
501	MiG-21UM	?	1968	
502 Black	MiG-21UM	09695152	1968	Green/blue camouflage. Preserved DAAFAR Museum, Havana
503	MiG-21UM	?	1968	Crashed 1979
504	MiG-21UM	?	1968	
505	MiG-21UM	?	1968	Crashed 1986
525	MiG-21UM	?		Noted 2005 stored Bayamo
531	MiG-21UM	?		
532	MiG-21UM	?		

UM7000 *Escuela de Aviación Militar 'Comandante Ché Guevara'*, the *Escuela de Enseñanza de Preparación Combativa* at San Julián, which was disbanded some years ago, still had a squadron of MiG-21MFs, which had been withdrawn from use and stored.

The last fighter variant was the MiG-21*bis* (*izdeliye* 75A), deliveries of which reportedly began in 1981. Altogether 80 (some Cuban sources suggest 90) were reportedly received, serving at their peak in four regiments. Again there is some confusion and the danger of double counting deliveries of MiG-21*bis* fighters, as several Cuban squadrons served in Angola. Serials were probably in the range 600-680.

In 1990 the MiG-21s were distributed as follows:

1ª *Brigada de Guardia 'Batalla de Santa Clara'* of *Zona Aérea Central* had

11° *Regimiento de Caza* at Santa Clara, with 111°and 112° *Escuadrones*, each of which had 15 MiG-21MFs and MiG-21UMs;

2ª *Brigada de Guardia 'Playa Girón'* of *Zona Aérea Occidental* (the Western Air Zone) had

21° *Regimiento de Caza*, San Antonio de los Baños with 211°and 212° *Escuadrones*, each of which had 15 MiG-21MFs and MiG-21UMs and

22° *Regimiento de Caza* at Baracoa, with 221° and 222° *Escuadrones*, each of which had 15 MiG-21MFs and MiG-21UMs

3ª *Brigada de Guardia 'Cuartel Moncada'* of *Zona Aérea Oriental* had

31° *Regimiento de Caza* at Camagüey with 311°and 312° *Escuadrones*, each of which had 15 MiG-21MFs and MiG-21UMs.

The situation in 2007 is:

UM1724 *Regimiento de Intercepción* (Interceptor Regiment) at Holguín has two MiG-21*bis* squadrons:

UM3710 *Escuadron de Intercepción* has some operational MiG-21bis and MiG-21UMs.

UM3840 *Escuadron de Intercepción* has had its MiG-21*bis* and MiG-21UMs withdrawn from use and stored.

UM1779 *Regimiento de Caza* at San Antonio de los Baños has

UM4748 *Escuadron de Intercepción* has a few MiG-21*bis* and MiG-21UMs still operational.

Escuela de Especialistas Menores 'Yuri Gargarin' (Junior [Technical] Specialists School), Ciudad Libertad, has one MiG-21bis available for its use.

A report suggests that by late 2007 only 12 MiG-21*bis* fighters and about six MiG-21UM trainers were operational.

It has not yet been revealed how many MiG-21 trainers have been delivered or their subtypes; however, the five aircraft delivered in 1966 (see opposite page) were almost certainly MiG-21U (*izdeliye* 66-600).

More of the same variant or even of the MiG-21US (*izdeliye* 68A) subtype may also have served in the FAR.

Deliveries of the more advanced MiG-21UM (*izdeliye* 69A) began in 1968 to San Antonio de los Baños and ultimately about 20 were received.

Cuban sources suggest that 270 MiG-21s in total were delivered to the Cuban Air Force.

▲ **MiG-21*bis* '665 Black' displays the rather garish green/blue camouflage which appears to be standard for DAAFAR fighters now.**

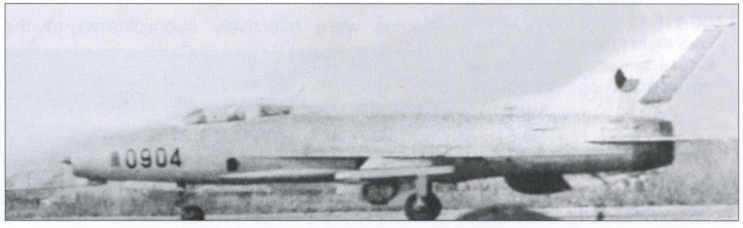
◄ **This MiG-21*bis* (possibly '661 Black') wears a non-standard four-tone camouflage scheme.**

Czechoslovakia/Czech Republic

The **Czechoslovak Air Force** (CzAF, or *Československé Vojenské Létectvo*) was re-established in 1945; in 1948 after the formation of a government led by the Communist Party it became more Soviet in style not only in aircraft used but also in organisation. There were two Air Armies: the 7th was independent of direct Army control and roughly equivalent to the Soviet PVO. It contained the interceptors and SAM sites, whilst the 10th was committed to tactical support of the army, which exercised direct control over the fighter-bombers and helicopters.

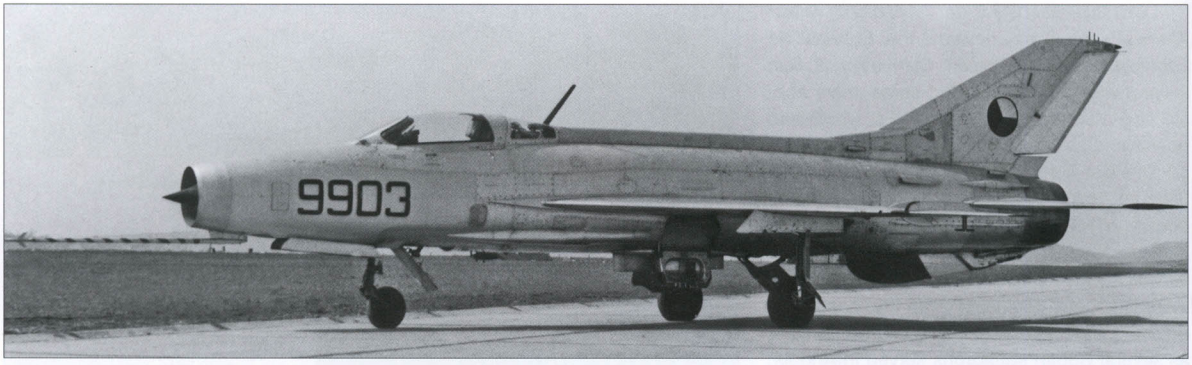
Until the attempted revolution in the spring of 1968 there were few Soviet units based in the country but, after the other Warsaw Pact countries crushed the insurgency, all Czech

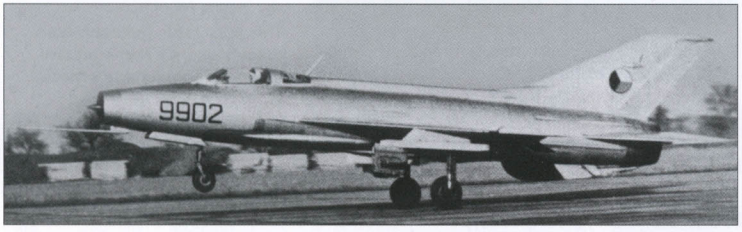
'0904 Black', the Soviet-built MiG-21F-13 delivered to Czechoslovakia as a pattern aircraft for licence production. ▼

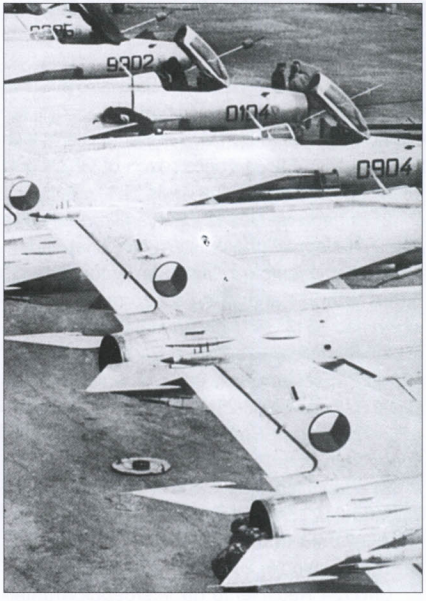


All photos via Internet

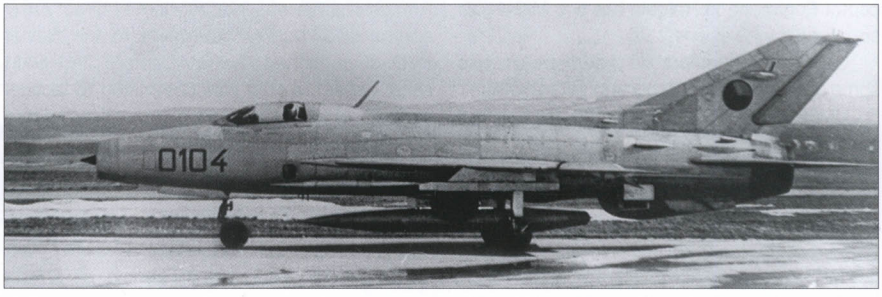
All photos via RART







▲▲ **The first three or four Czech-built MiG-21F-13s (Aero S-106s), including '9902 Black' and '9903 Black', still had the small transparency aft of the seat.**

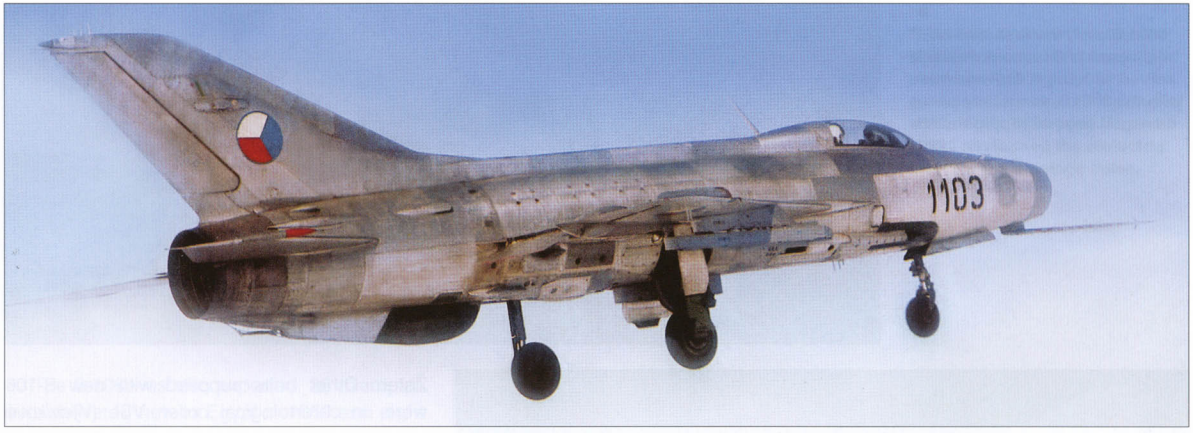


▲► **Most S-106s, such as '0104 Black' and '0220 Black', had a 'solid' fairing with no transparency aft of the cockpit.**

►▲ **MiG-21F-13 '0904 Black' shares the flight line with at least six S-106s, including '9902 Black', '0104 Black' and '0206 Black'.**

forces were effectively subordinated to the Group of Soviet Forces in Czechoslovakia (later renamed the Central Group of Forces).

Deliveries of the MiG-21F-13 (*izdeliye* 74) to the Warsaw Pact countries started in 1961, but Czechoslovakia was exceptional in that it was permitted to manufacture the new fighter under licence. The Mikoyan OKB worked very closely with the Aero Vodochody National Corporation, which built 194 MiG-21F-13s under the local designation S-106. With the exception of the pattern aircraft ('0904 Black' No. 1, c/n N74210904), all CzAF examples were locally built. At the end of the 1960s the designation S-106 was dropped and the Czech-built fighters were henceforth referred to as MiG-21F-13s.

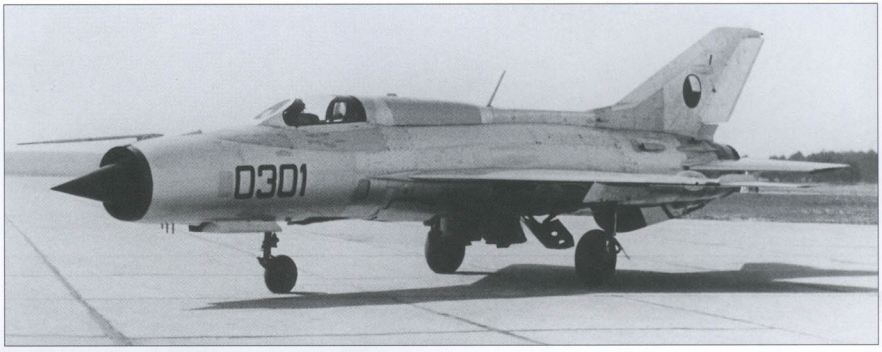


L+K

The first S-106 entirely manufactured by Aero was given the serial '0001 Black' and was tested to destruction at the VZLÚ (*Výzkumni a Zkušební Létecký Ústav*, Aeronautical Research and Test Institute). Czech-built MiG-21F-13s had six-digit construction numbers. The first digit indicated the year of production, the second digit was always 6 (standing for S-106); the next two digits identified the batch number and the final two the number of the aircraft in the batch. For example, 460103 means the third aircraft of Batch 01, built in 1964. (Surprisingly, the first four machines assembled by Aero from Soviet-supplied kits had c/ns indicating Batch 99.) CzAF serials were

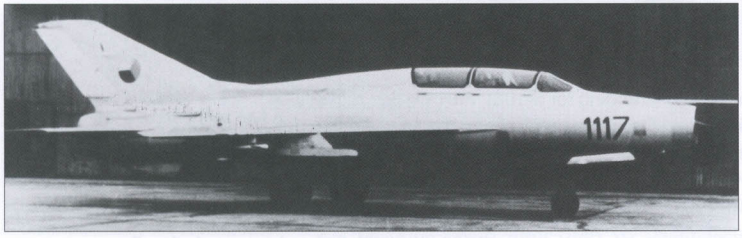
▲ **A fine air-to-air of a late-production MiG-21F-13 (S-106). Note the red-painted tips of the stabilator anti-flutter weights to attract attention and thus prevent injury to ground crews.**

Czechoslovak Air Force MiG-21F-13 (Moscow-built), 1962
0904
MiG-21F-13 (Aero S-106), CzAF Flight Training Centre (VSL), 1965
0210
Czechoslovak Air Force MiG-21F-13 (Aero S-106), 5. SLP, 1971
1013

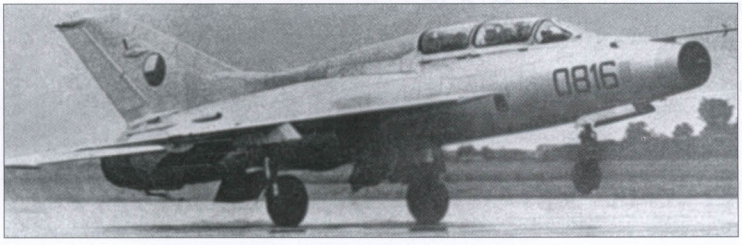


via RART

▶ **'0301 Black', the first MiG-21PF delivered to Czechoslovakia. It served with the 1. SLP and later with the 8. SLP, eventually being damaged beyond repair on 28th June 1985.**



via RART



via RART

▲▲ **MiG-21U (*izdeliye* 66-400) '1117 Black' of 9. SLP appears to have a small pylon or pod outboard of the usual missile pylon.**

▲ **MiG-21U (*izdeliye* 66-400) '0816 Black' in its days as a standard trainer with the 1. LŠP. It was later converted into an ejection seat testbed registered OK-016.**

black with thin white edges and usually matched the last four digits of the c/n.

The four S-106s assembled from CKD kits were identical to the Soviet-built version, but all subsequent examples featured a metal panel to replace the fixed transparency behind the pilot's seat; a practice adopted on future variants of the MiG-21 built in the USSR.

The first unit to receive the S-106 was the 11. SLP (*stíhací letecký pluk*, fighter regiment) at Žatec. Other units supplied with new S-106 were, in chronological order: VSL (*Výcvikové středisko létectva*, Flying Training Centre); 1. SLP at Přerov; 1. LŠP (*letecký školský pluk*, Training Air Regiment), also at Přerov; 4. SLP at Pardubice; 8. SLP at Mošnov; 9. SLP at Bechyně.

Some S-106s were given the capability of carrying an underwing pod holding cameras for photo reconnaissance missions and given the local designation **MiG-21FR**. Such aircraft are duly marked in the table on pages 508-512.

When more modern variants of the MiG-21 were supplied from the USSR the S-106s were passed on to the VLU (*Vojenská Letecká Učiliště*, Military Flying School) at Přerov, 5 SLP at Plzeň-Líně and 47. PZLP (*průzkumní letecký pluk*, Reconnaissance Air Regiment) at Pardubice.

Other acronyms used in the tables below are:

VZS (*Výzkumní a zkušební středisko*) Test and Development Unit;

LOK (*Letecké Opravny Kbely*) the CzAF Aircraft Repair Plant at Prague-Kbely;

LZO (*Letecký Zkušebni Odbor*) Aerial Test Section of a CzAF base;

LOZ (*Letecká Opravárenská Základna*) Aircraft Maintenance Base;

VM VHÚ (*Vojenský Muzeum Vojenského Historického Ústavu*) Military Museum of the Military Historical Society, Prague-Kbely.

via internet

▶ **'Tie a yellow ribbon 'round the old oak tree.' MiG-21PFM '7913 Black' equipped with a GP-9 cannon pod wears a yellow band around the rear fuselage, indicating it is withdrawn from active duty in compliance with arms limitation treaties.**

via RART

◄
'1923 Black', one of the CzAF's MiG-21R reconnaissance jets, is shown here in fighter configuration minus mission pod and wingtip ECM pods. Export MiG-21Rs lasked the dielectric insert in the fuselage spine.

The S-106 was also exported. 26 examples were delivered new to Egypt in 1969 and eight ex-CzAF machines were transferred to Syria in 1973 to help replace the losses sustained in the Six-Day War with Israel.

Although the MiG-21F-13 remained in licence production in Czechoslovakia until 1972, a more advanced version started to arrive in 1964 when the first of forty MiG-21PF (*izdeliye* 76) fighters was received. These new aircraft were distributed between 1., 8. and 11. SLP. Subsequently some were transferred to 9. SLP before surviving examples were retired in 1990.

The MiG-21PFM (*izdeliye* 94A and 94N) was the next variant to be delivered between August 1966 and January 1969. Initial deliveries with serials between 4311 Black and 5411 Black were not able to carry the GP-9 gun pod, but 7114 Black and later examples had this facility. The last nine (?) aircraft in serial order represented the *izdeliye* 94N version able to deliver tactical nuclear bombs. Allocation of new aircraft was to 1., 8., 9. and 11. SLP. The survivors were withdrawn from use in 1991 but many of those not preserved were not scrapped until 1994.

The first of the third-generation MiG-21s in CzAF service was the MiG-21R (*izdeliye* 94RA); deliveries started in January 1969 and continued until January 1972 by which time 25 had arrived. All were initially allocated to 47. PZLP but, when replaced by more modern types in 1992-94, the MiG-21Rs were transferred to 28. SBoLP (*stíhací-bombardovací letecký pluk*, fighter-bomber regiment).

L+K

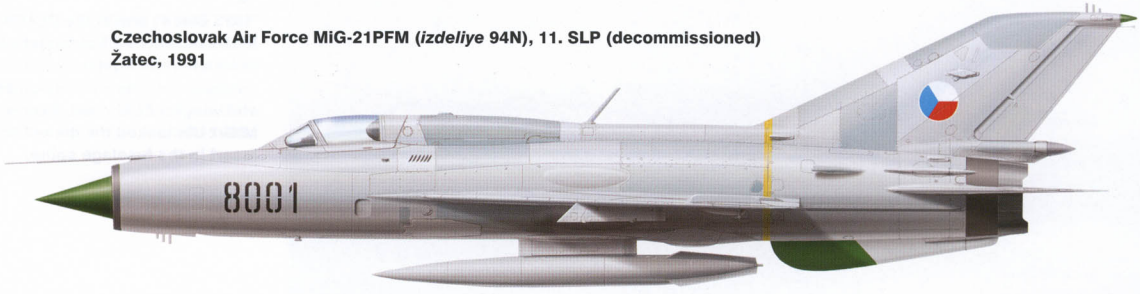
▲
MiG-21MF '7707 Black' in service with the 9. SBoLP. The aircraft is armed with S-24 heavy unguided rockets.

The success of the MiG-21R encouraged the OKB to develop better fighter versions and between July 1969 and the end of June 1970 the CzAF received 24 MiG-21M (*izdeliye* 96) fighters. Compared with their Soviet counterparts (the MiG-21S and MiG-21SM) they had the less capable RP-21MA radar instead of the RP-22 Sapfir-21. All went at first to 4. SLP at Pardubice and were the first export variant with a built-in cannon. However, the baffle plates below the

Two 11. SLP MiG-21PFMs formate with a MiG-21US ('0948 Black') from the same unit. '4410 Black' gained this special colour scheme when the 11. SLP received the honorary appellation *Invazní* (Invasion Regiment).
▼

Jan Kouba

Czechoslovak Air Force MiG-21PFM (*izdeliye* 94N), 11. SLP (decommissioned)
Žatec, 1991



Czechoslovak Air Force MiG-21PFM (*izdeliye* 94A), 11. SLP (decommissioned)
Vodochody, 1991

Czechoslovak Air Force MiG-21F-13s

Serial	Version	C/n	Delivery date	First unit	Comments
0001 Black	MiG-21F-13	360001			First entirely Avia-built airframe. Tested to destruction at VZLÚ
0002	MiG-21F-13	360002	7-11-63	11. SLP	Withdrawn 1973, sent to Syria
0003	MiG-21F-13	360003	7-11-63	11. SLP	Withdrawn 1965-6
0004 Black	MiG-21F-13	360004	7-11-63	11. SLP	Silver overall. Withdrawn 1973, sent to Syria
0005	MiG-21F-13	360005	7-11-63	11. SLP	To VLU Prešov 1992 as ground instructional airframe, later Prešov Museum, Slovakia, as '0088'
0101	MiG-21F-13	360101	4-5-64	VSL	9. SLP, withdrawn 1973, sent to Syria
0102	MiG-21F-13	360102	6-4-64	11. SLP	Withdrawn 1973, sent to Syria
0103	MiG-21F-13	460103	9-4-64	11. SLP	9. SLP, withdrawn 1973 Bechyně, 4-1987 scrapped
0104 Black	MiG-21F-13	460104	28-4-64	11. SLP	VLU Prešov 1992 as ground instructional airframe, silver overall. Stored 1996 Trenčín for Military Museum Piešťany
0105	MiG-21F-13	460105	5-6-64	VSL	9. SLP, withdrawn and decommissioned 3-1988 Bechyně, cockpit to VLU Prešov as ground instructional aid
0106	MiG-21F-13	460106	15-5-64	11. SLP	Withdrawn 1973, sent to Syria
0107	MiG-21F-13	460107	10-7-64	11. SLP	To Brno 1992 as ground instructional airframe
0108	MiG-21F-13	460108	10-7-64	VSL	Total loss 18-3-1970
0109	MiG-21F-13	460109	15-1-65	1. SLP	VLU Prešov 1993 as ground instructional airframe, stored 1996 Trenčín for Military Museum Piešťany
0110	MiG-21F-13	460110	6-8-64	VSL	Destroyed by fire on 9. SLP's hardstand 7-1977, formally written off probably as late as 3-1988
0111	MiG-21F-13	460111	9-9-64	11. SLP	Crashed 26-9-1964
0201 Black	MiG-21F-13	460201	12-10-64	11. SLP	5. SLP, silver overall. Withdrawn 16-12-1988, sold to Hungary, now preserved McClellan AFB, USA, without insignia
0202 Black	MiG-21F-13	460202	13-11-64	11. SLP	5. SLP, silver overall. Stored Kbely for Prague Technical Museum
0203	MiG-21F-13	460203	15-1-65	11. SLP	1. SLP, 9. SLP, converted to photo-reconnaissance version, withdrawn 3-1988 and decommissioned at Bechyně, later scrapped
0204	MiG-21F-13	460204	15-1-65	11. SLP	26-1965 damaged whilst landing at České Budějovice and decommissioned, since 1990 ground instructional airframe VLU Prešov
0205	MiG-21F-13	460205	15-1-65	1. SLP	Scrapped at VLU Prešov 1990-91
0206	MiG-21F-13	460206	26-2-65	1. SLP	4. SLP, crashed 27-4-1978
0207	MiG-21F-13	560207	31-3-65	VSL	9. SLP, withdrawn 12-1988 and sold to Hungary
0208	MiG-21F-13	560208	22-10-65	1. SLP	4. SLP, crashed 27-6-1987

0209	MiG-21F-13	560209	3-5-65	VSL	9. SLP, withdrawn 3-1988 and decommissioned at Bechyně
0210 Black	MiG-21F-13	560210	5-4-65	VSL	1. SLP, silver overall. Currently stored VM VHÚ
0211	MiG-21F-13	560211	5-4-65	VSL	Crashed 27-4-1967
0212 Black	MiG-21F-13	560212	5-4-65	VSL	5. SLP, 9. SLP, silver overall. Withdrawn 1988 and decommissioned Bechyně, currently stored VM VHÚ
0213	MiG-21F-13	560213	5-4-65	VSL	4. SLP, withdrawn 1973, sent to Syria
0214	MiG-21F-13	560214	12-7-65	VSL	9. SLP withdrawn 1973, sent to Syria
0215	MiG-21F-13	560215	3-5-65	VSL	4. SLP, written off Pardubice 23-8-1965 after accident
0216	MiG-21F-13	560216	14-5-65	VSL	9. SLP, withdrawn Bechyně 28-10-1970 after accident
0217	MiG-21F-13	560217	31-5-65	4. SLP	5. SLP
0218	MiG-21F-13	560218	6-5-65	4. SLP	Withdrawn Pardubice 23-8-1965 after collision with MiG-21F-13 '0503 Black'
0219	MiG-21F-13	560219	9-6-65	4. SLP	Withdrawn Pardubice 10-7-1969 after accident
0220 Black	MiG-21F-13	560220	9-6-65	4. SLP	5. SLP, silver overall. Withdrawn 16-12-1988 and preserved Ozigetvar Múzeum, Alsónémedi, Hungary
0301	MiG-21F-13	560301	10-7-65	4. SLP	9. SLP, 4. SLP, 9. SLP, withdrawn at Bechyně 12-1988, sold to Hungary, later preserved at USAF Museum, Dayton, OH, USA, as Vietnamese People's Air Force '5063 Red'
0302	MiG-21F-13	560302	10-7-65	4. SLP	9. SLP, withdrawn 1973, sent to Syria
0303 Black	MiG-21F-13	560303	12-7-65	VSL	9. SLP, operated by the 'Box' aerobatic team, silver overall. Crashed 1-4-1985
0304 Black	MiG-21F-13	560304	12-7-65	VSL	9. SLP, 4. SLP, silver overall. Withdrawn 4-1989, gate guard at LOK with sharkmouth added; now stored VM VHÚ
0305 Black	MiG-21F-13	560305	26-7-65	VSL	1. SLP, silver overall, two yellow stripes on tail. Currently stored VM VHÚ
0306	MiG-21F-13	560306	13-8-65	VSL	9. SLP, operated by the 'Box' aerobatic team, withdrawn 6-1986, scrapped Bechyně and cockpit section sent to VM VHÚ
0307	MiG-21F-13	560307	27-9-65	1. SLP	1. LŠP, withdrawn 21-3-1991 and transferred to Vodochody where scrapped 19-5-1993
0308	MiG-21F-13	560308	7-9-65	VSL	9. SLP, withdrawn Bechyně 6-1-1966 after accident
0309 Black	MiG-21F-13	560309	8-9-65	VSL	9. SLP, 1. SLP, 9. SLP, operated by the 'Box' aerobatic team, silver overall. Decommissioned 1989 Pardubice Museum, stored Kbely 1991, now preserved Zruč Air Park
0310 Black	MiG-21F-13	560310	8-9-65	VSL	9. SLP, operated by the 'Box' aerobatic team, silver overall. Decommissioned 3-1988 and sent to Aeroklub Soběslav, preserved 9-8-1993 Bad Ischl Museum
0311	MiG-21F-13	560311	27-9-65	1. LŠP	Withdrawn 18-5-1971 České Budějovice after accident
0312	MiG-21F-13	560312	1-10-65	VSL	9. SLP, 4. SLP, 9. SLP, operated by the 'Box' aerobatic team, decommissioned 1988 at Bechyně, now preserved at Zruč Air Park
0313 Black	MiG-21F-13	560313	6-10-65	VSL	Silver overall. Preserved VM VHÚ
0314	MiG-21F-13	560314	12-10-65	9. SLP	4. SLP, transferred 17-1-1990 to 5. SLP for decommissioning but ferried to Vodochody to be sold and not withdrawn until 15-11-1992 then believed to be ground instructional airframe at Košice
0315 Black	MiG-21F-13	560315	1-11-65	1. SLP	Silver overall, red stripe on the fin. To Slovakia 1993, now preserved Košice in the town
0316 Black	MiG-21F-13	560316	27-12-65	9. SLP	9. SLP, operated by the 'Box' aerobatic team, 4. SLP, silver overall. Ferried 6-1989 to 5. SLP, for decommissioning, then moved to Přerov and withdrawn from use 1991 and scrapped there 1992
0317	MiG-21F-13	560317	26-11-65	1. SLP	1. LŠP, withdrawn 20-3-1991 sent to Vodochody and scrapped 26-5-1993
0318	MiG-21F-13	560318	26-11-65	1. SLP	Withdrawn 20-7-1967 after accident at České Budějovice
0319	MiG-21F-13	560319	22-12-65	11. SLP	
0320	MiG-21F-13	560320	22-12-65	11. SLP	Withdrawn Žatec 25-11-1968 after accident
0321	MiG-21F-13	560321	22-12-65	9. SLP	Withdrawn Bechyně 9-7-1968 after accident
0401	MiG-21F-13	560401	22-12-65	VSL	5. SLP, 9. SLP
0402	MiG-21F-13	660402	20-6-66	VZS	5. SLP, prototype for **MiG-21FR** photo reconnaissance version with underwing camera pod, written off 22-9-1981 at Plzeň-Líně (?) after in-flight collision with MiG-21F-13 '0505 Black'
0403	MiG-21F-13	660403	10-3-66	11. SLP	9. SLP, operated by the 'Box' aerobatic team, 4. SLP, decommissioned 6-1986
0404	MiG-21F-13	660404	12-4-66	11. SLP	1. LŠP, withdrawn 20-7-1967 after collision with 0405 at Přerov
0405	MiG-21F-13	660405	18-3-66	11. SLP	1. LŠP, withdrawn 20-7-1967 after collision with 0404 at Přerov
0406	MiG-21F-13	660406	1-4-66	11. SLP	1. LŠP, withdrawn 22-3-1991, transported to Vodochody, scrapped 24-8-1993
0407	MiG-21F-13	660407	1-4-66	11. SLP	8. SLP, 4. SLP, 5. SLP, up for sale, decommissioned Plzeň-Líně 15-11-1992, nose preserved Přerov?
0408	MiG-21F-13	660408	12-4-66	11. SLP	1. LŠP, withdrawn 27-3-1991 and flown to Vodochody where scrapped 25-5-1993
0409	MiG-21F-13	660409	12-4-66	11. SLP	Withdrawn Žatec 20-11-1968 after accident
0410	MiG-21F-13	660410	12-4-66	11. SLP	9. SLP, operated by the 'Box' aerobatic team, 4. SLP, 1. LŠP, withdrawn 27-3-1991, moved to Vodochody and scrapped there 25-5-1994
0411	MiG-21F-13	660411	30-4-66	1. SLP	9. SLP, 4. SLP, 1. LŠP, withdrawn 21-9-1991, ferried to Vodochody and scrapped 24-8-1993
0412 Black	MiG-21F-13	660412	28-4-66	1. SLP	5. SLP, bluish green/dark earth camouflage. Stored 1996 Trenčín, earmarked for Military Museum Piešťany
0413	MiG-21F-13	660413	12-5-66	1. SLP	Crashed 25-11-1968

0414	MiG-21F-13	660414	12-5-66	1. SLP	Withdrawn 11-1990 at Prešov
0415	MiG-21F-13	660415	31-5-66	1. SLP	1. LŠP withdrawn Přerov 20-7-1967 after accident
0416	MiG-21F-13	660416	31-5-66	1. SLP	Damaged and repaired at 1. SLP 9-1974, 9. SLP, 5. SLP, 1. LŠP, ferried to Vodochody 22-3-1991, stored, allocated to Slovakia and 9-6-1993 moved to Sliač, stored there and later scrapped
0417	MiG-21F-13	660417	8-6-66	1. SLP	1. LŠP, withdrawn 22-3-1991 and moved from Přerov to Vodochody where scrapped 24-8-1993
0418	MiG-21F-13	660418	8-6-66	1. SLP	1. LŠP, decommissioned 1991 Přerov, 12-1992 ground instructional airframe Mošnov
0419	MiG-21F-13	660419	8-7-66	VSL	1. SLP, 5. SLP
0420	MiG-21F-13	660420	8-7-66	VSL	1. LŠP, withdrawn 22-3-1991 when moved from Přerov to Vodochody, allocated to Slovakia and 9-6-1993 transported to Sliač, stored there but later scrapped
0501	MiG-21F-13	660501	11-7-66	1. SLP	Withdrawn 21-3-1974 České Budějovice after accident
0502	MiG-21F-13	660502	11-7-66	1. SLP	1. LŠP, decommissioned 22-3-1991 and moved from Přerov to Vodochody, allocated to Slovakia, moved 9-6-1993 to Sliač, stored there and later scrapped
0503	MiG-21F-13	660503	27-8-66	4. SLP	Crashed 27-3-1968 Pardubice after collision with MiG-21F-13 '0218 Black'
0504	MiG-21F-13	660504	27-8-66	4. SLP	9. SLP, decommissioned 12-1988 at Bechyně
0505	MiG-21F-13	660505	27-8-66	4. SLP	5. SLP, damaged 22-9-1981 after in-flight collision with MiG-21F-13 '0402 Black' but landed safely; damaged again when landing Plzeň-Líně 27-5-1988 and repaired but struck off charge
0506	MiG-21F-13	660506	27-8-66	4. SLP	5. SLP, preserved Prague-Malešice as '7714' in the early 1990s, noted 9-2004
0507	MiG-21F-13	660507	8-9-66	4. SLP	5. SLP, in the 1980s used as fire trainer at Plzeň-Líně, formally written off 1988
0508	MiG-21F-13	660508	8-9-66	4. SLP	crashed 30-11-1966 at Pardubice
0509	MiG-21F-13	660509	22-10-66	4. SLP	Withdrawn Pardubice 27-5-1969 after accident
0510	MiG-21F-13	660510	22-10-66	4. SLP	Withdrawn at Pardubice 10-10-1967 after accident
0511	MiG-21F-13	660511	7-10-66	VSL	
0512	MiG-21F-13	660512	10-10-66	VSL	Ground instructional airframe at Brno-Slatina
0513	MiG-21F-13	660513	11-11-66	4. SLP	5. SLP, last flight 11-1-1990, earmarked for decommissioning at No. 32 Aircraft repair Plant 25-6-1990, moved to Přerov 25-1-1991 and decommissioned there
0514 Black	MiG-21F-13	660514	31-10-66	4. SLP	5. SLP, silver overall. Withdrawn 8-1989 and moved to Kunovice Museum for preservation
0515 Black	MiG-21F-13	660515	17-11-66	11. SLP	1992-3 ground instructional airframe Prešov, silver overall. Now preserved at Košice Airport Museum, Slovakia
0516	MiG-21F-13	660516	17-11-66	11. SLP	5. SLP, 4. SLP, 1. LŠP, withdrawn 27-3-1991 Přerov and ferried to Vodochody, 25-6-1993 moved to Sliač, Slovakia, stored there and later scrapped
0517	MiG-21F-13	660517	21-12-66	11. SLP	5. SLP, 4. SLP, 1. LŠP, decommissioned 1989 Přerov, becoming a monument at Želatovice, from 1994 mounted on a platform at Přerov
0518	MiG-21F-13	660518	21-12-66	11. SLP	1. LŠP, withdrawn 21-3-1991 Přerov and ferried to Vodochody, 9-6-1993 moved to Sliač, Slovakia, stored there and later scrapped
0519	MiG-21F-13	660519	12-1-67	8. SLP	Crashed 14 or 18-6-1968 at Mošnov
0520 Black	MiG-21F-13	660520	30-12-66	1. SLP	4. SLP, 5. SLP, silver overall. 5-1989 reportedly to Plzeň-Líně for decommissioning, currently preserved Brno-Kralovo Technical Museum
0601	MiG-21F-13	760601	30-12-66	1. SLP	4. SLP, withdrawn 25-9-1969 after accident
0602	MiG-21F-13	760602	17-2-67	8. SLP	Preserved Zruč Air Park since the 1990s
0603	MiG-21F-13	760603	21-3-67	8. SLP	Preserved Zruč Air Park in the 1990s but sold 1996 to Bad Ischl Museum
0604	MiG-21F-13	760604	17-2-67	8. SLP	1. LŠP, ferried to Vodochody for decommissioning, allocated to Slovakia and moved to Sliač 9-6-1993, stored there and later scrapped
0605	MiG-21F-13	760605	3-3-67	8. SLP	1. LŠP, ferried 21-3-1991 to Vodochody for decommissioning, allocated to Slovakia and moved to Sliač 9-6-1993, stored there and later scrapped
0606	MiG-21F-13	760606	3-3-67	8. SLP	9. SLP, 4. SLP, 1. LŠP, decommissioned 27-3-1991 and ferried from Přerov to Vodochody where scrapped 26-5-1994
0607	MiG-21F-13	760607	14-4-67	4. SLP	9. SLP, operated by the 'Box' aerobatic team 1968-9, 5. SLP, 9. SLP, decommissioned 1988 at Bechyně and reportedly moved to Klatov Aeroclub
0608	MiG-21F-13	760608	5-4-67	9. SLP	5. SLP, 9. SLP, decommissioned 1988 at Bechyně
0609	MiG-21F-13	760609	5-4-67	9. SLP	**MiG-21FR**, operated by the 'Box' aerobatic team 1968-9, 4. SLP, 5. SLP, 6-1989 moved to Plzeň-Líně earmarked for sale, at 1. SLP 1991, withdrawn and ferried to Vodochody 21-3-1991, allocated to Slovakia and moved to Sliač 25-6-1993, stored there and later scrapped
0610	MiG-21F-13	760610	5-4-67	4. SLP	**MiG-21FR**, 9. SLP, operated by the 'Box' aerobatic team 1968-9, 5. SLP, 4. SLP,
0611	MiG-21F-13	760611	2-5-67	4. SLP	**MiG-21FR**, 5. SLP, 9. SLP
0612	MiG-21F-13	760612	7-5-67	9. SLP	**MiG-21FR**, 9. SLP
0613 Black	MiG-21F-13	760613	7-5-67	9. SLP	**MiG-21FR**, silver overall. Repaired while in service after collision at Bechyně with 0110 in 7-1977, at 9. SLP in 1988, now preserved VM VHÚ

0614	MiG-21F-13	760614	?-5-67	4. SLP	**MiG-21FR**, 5. SLP, 1. LŠP, 27-3-1991 ferried from Přerov to Vodochody, 21-3-1991, allocated to Slovakia and moved to Sliač 25-6-1993, stored there and later scrapped
0615 Black	MiG-21F-13	760615	3-6-67	8. SLP	**MiG-21FR**, 9. SLP, silver overall. In 1983 used at 9. SLP for fire practice, finally written off 10-1983
0616	MiG-21F-13	760616	13-6-67	8. SLP	**MiG-21FR**, 4. SLP, 11. SLP, accident 15-4-1971 at Žatec and withdrawn from service
0617	MiG-21F-13	760617	22-6-67	8. SLP	**MiG-21FR**, 5. SLP, 1. LŠP, withdrawn 21-3-1991 and ferried from Přerov to Vodochody, allocated to Slovakia and moved to Sliač 9-6-1993, later scrapped
0618	MiG-21F-13	760618	13-6-67	8. SLP	**MiG-21FR**, 47. PZLP, 1/4. SLP, 1. LŠP, crashed 21-5-1983 at Přerov, killing the Libyan trainee pilot
0619	MiG-21F-13	760619	3-7-67	8. SLP	**MiG-21FR**, 47. PZLP, 1/4. SLP, believed to have become gate guard at LOK
0620	MiG-21F-13	760620	3-7-67	VSL	**MiG-21FR**, in 1990 scrapped at Prešov
0701	MiG-21F-13	760701	?-10-67	9. SLP	**MiG-21FR**, 5. SLP, 1. LŠP, decommissioned 27-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 25-6-1993, stored there and later scrapped
0702	MiG-21F-13	760702	3-7-67	VSL	**MiG-21FR**, to VSL
0703	MiG-21F-13	760703	1-8-67	8. SLP	**MiG-21FR**, 47. PZLP, 1/4 ALP
0704	MiG-21F-13	760704	10-8-67	8. SLP	**MiG-21FR**, 47. PZLP, 1/4 ALP, in 1997 ground training airframe at Brno-Slatina
0705	MiG-21F-13	760705	14-9-67	9. SLP	**MiG-21FR**, withdrawn from use Bechyně 11-8-1970 after accident
0706	MiG-21F-13	760706	14- 9- 67	9. SLP	**MiG-21FR**
0707	MiG-21F-13	760707	23-9-67	8. SLP	**MiG-21FR**, 47 PZLP, 1/4/5. SLP, 5. SLP, 4. SLP, 1. LŠP, damaged in wheels-up landing Přerov 14-7-1990 with Hungarian trainee pilot, written off Přerov 1991, noted Vodochody 19-6-1992, scrapped 12-1992
0708	MiG-21F-13	760708	6-10-67	8. SLP	**MiG-21FR**, 47. PZLP, 4. SLP, 9. SLP, decommissioned Bechyně 9-4-1979 after accident
0709	MiG-21F-13	760709	6-10-67	8. SLP	**MiG-21FR**
0710	MiG-21F-13	760710	17-11-67	9. SLP	**MiG-21FR**, 4. SLP, 1. LŠP, withdrawn from use 27-3-1991 and ferried to Vodochody, allocated to Slovakia and moved to Sliač 25-6-1993, stored there, now preserved 25-6-1993 Martin Air Museum, Slovakia
0711 Black	MiG-21F-13	760711	30-11-67	4. SLP	**MiG-21FR**, 5. SLP, silver overall. 8-1989 Hrabyně Museum, now preserved Zruč Air Park
0712	MiG-21F-13	760712	13-11-67	4. SLP	**MiG-21FR**, 5. SLP, 9. SLP, 1990s earmarked and currently stored for Military Museum, Piešťany
0713	MiG-21F-13	760713	13-11-67	4. SLP	**MiG-21FR**, 9. SLP, crashed 26-1-1973 at Bechyně
0714	MiG-21F-13	760714	22-12-67	VSL	**MiG-21FR**, preserved 1992 Prešov Museum, Slovakia
0801	MiG-21F-13	860801			Transferred to Egypt 24-3-1969 to 14-4-1969
0802	MiG-21F-13	860802			Transferred to Egypt 24-3-1969 to 14-4-1969
0803	MiG-21F-13	860803			Transferred to Egypt 24-3-1969 to 14-4-1969
0804	MiG-21F-13	860804			Transferred to Egypt 24-3-1969 to 14-4-1969
0805	MiG-21F-13	860805			Transferred to Egypt 24-3-1969 to 14-4-1969
0806	MiG-21F-13	860806			Transferred to Egypt 15-4-1969 to 3-6-1969
0807	MiG-21F-13	860807			Transferred to Egypt 15-4-1969 to 3-6-1969
0808	MiG-21F-13	860808			Transferred to Egypt 15-4-1969 to 3-6-1969
0809	MiG-21F-13	860809			Transferred to Egypt 15-4-1969 to 3-6-1969
0810	MiG-21F-13	860810			Transferred to Egypt 15-4-1969 to 3-6-1969
0811	MiG-21F-13	860811			Transferred to Egypt 15-4-1969 to 3-6-1969
0812	MiG-21F-13	860812			Transferred to Egypt 15-4-1969 to 3-6-1969
0813	MiG-21F-13	860813			Transferred to Egypt 15-4-1969 to 3-6-1969
0814	MiG-21F-13	860814			Transferred to Egypt 15-4-1969 to 3-6-1969
0815	MiG-21F-13	860815			Transferred to Egypt 15-4-1969 to 3-6-1969
0901	MiG-21F-13	960901			Transferred to Egypt 12-6-1969 to 31-7-1969
0902	MiG-21F-13	960902			Transferred to Egypt 12-6-1969 to 31-7-1969
0903	MiG-21F-13	960903	17-7-69	8. SLP	**MiG-21FR**, noted at VLU Prešov as training aid, 1993 still there, allocated to Slovakia, stored 1996 Trenčín for Military Museum Piešťany noted 2006
0904 Black (1)	MiG-21F-13	N74210904	27-9-62	VSL	Supplied by USSR as pattern aircraft
0904 (2)	MiG-21F-13	960904	15-7-69	9. SLP	**MiG-21FR**
0905	MiG-21F-13	960905	8-8-69	VSL	**MiG-21FR**, 5. SLP, 1. LŠP, decommissioned 25-9-1990, scrapped Prešov
0906	MiG-21F-13	960906	19-9-69	9. SLP	**MiG-21FR**, 5. SLP, 1. LŠP, decommissioned 27-3-1991 and ferried to Vodochody, moved to Kbely 12-7-1994, then sold to Lafayette Museum Orange, then to Orange Base Museum, France
0907	MiG-21F-13	960907			**MiG-21FR**, transferred to Egypt 4-9-1969 to (?) 4-12-1969
0908	MiG-21F-13	960908			**MiG-21FR**, transferred to Egypt 4-9-1969 to (?) 4-12-1969
0909	MiG-21F-13	960909			**MiG-21FR**, transferred to Egypt 4-9-1969 to (?) 4-12-1969
0910	MiG-21F-13	960910			**MiG-21FR**, transferred to Egypt 4-9-1969 to (?) 4-12-1969
0911	MiG-21F-13	960911			**MiG-21FR**, transferred to Egypt 4-9-1969 to (?) 4-12-1969

0912	MiG-21F-13	960912			**MiG-21FR**, transferred to Egypt 4-9-1969 to (?) 4-12-1969
0913	MiG-21F-13	960913			**MiG-21FR**, transferred to Egypt 4-9-1969 to (?) 4-12-1969
0914	MiG-21F-13	960914			**MiG-21FR**, transferred to Egypt 4-9-1969 to (?) 4-12-1969
0915	MiG-21F-13	960915			**MiG-21FR**, transferred to Egypt 4-9-1969 to (?) 4-12-1969
1001	MiG-21F-13	061001	12-2-71	5. SLP	**MiG-21FR**, withdrawn 3-1993 and scrapped Bechyně
1002 Black	MiG-21F-13	061002	12-2-71	5. SLP	**MiG-21FR**, silver overall, unit badge on nose
1003 Black	MiG-21F-13	061003	26-2-71	1. LŠP	**MiG-21FR**, 1. SLP, 5. SLP, silver overall, red fin cap. Noted 2004 preserved but partially dismantled Vyškov Museum
1004	MiG-21F-13	061004	1-9-71	1. LŠP	**MiG-21FR**, crashed 23-9-1974 Přerov
1005 Black	MiG-21F-13	061005	22-2-71	9. SLP	**MiG-21FR**, 4. SLP, silver overall. Noted in 1990s at Kralupy, now pr eserved at yard in Roudnice
1006	MiG-21F-13	061006	22-2-71	9. SLP	**MiG-21FR**, 5. SLP, written off 20-9-1990 Plzeň-Líně after accident
1007	MiG-21F-13	061007	6-5-71	1. LŠP	**MiG-21FR**, 1. SLP, scrapped Prešov 20-9-1990
1008	MiG-21F-13	061008	6-5-71	1. LŠP	**MiG-21FR**, scrapped Prešov 29-9-1990
1009	MiG-21F-13	061009	1-6-71	5. SLP	**MiG-21FR**, preserved Zruč Air Park in 1990s
1010	MiG-21F-13	061010	11-6-71	5. SLP	**MiG-21FR**, 1. SLP, 5. SLP, withdrawn Plzeň-Líně after accident on 26-9-1977
1011	MiG-21F-13	061011	18-6-71	5. SLP	**MiG-21FR**, 1. LŠP, ferried from Přerov to Vodochody and decommissioned 22-3-1991, 11-7-1994 moved to LOK, 11-11-1994 sold in Clarkston, USA, where 1996 registered as N1011E to D.R.Hunt, now with Merle Maine Enterprises, Ontario, OR, USA
1012	MiG-21F-13	061012	18-6-71	1. SLP	**MiG-21FR**, 1. LŠP, scrapped 1991 Přerov
1013	MiG-21F-13	061013	16-6-71	5. SLP	**MiG-21FR**, withdrawn 1990 and stored VM VHÚ
1014	MiG-21F-13	061014	16-6-71	5. SLP	**MiG-21FR**, in 1990s sold to LOK and subsequently reported resold, probably to the USA
1015	MiG-21F-13	061015	16-6-71	5. SLP	**MiG-21FR**, 1. LŠP, sold 1994 (reportedly to Ch.P.Treiber)
1016	MiG-21F-13	061016	13-10-71	8. SLP	**MiG-21FR**, 1. LŠP, written off Přerov 31-5-1982 after accident involving trainee Libyan pilot
1101	MiG-21F-13	161101	17-11-71	1. SLP	**MiG-21FR**, 1. LŠP, ferried from Přerov to Vodochody 13-7-1994, sold 13-7-1994 to LOK, resold 3-11-1994 as N1011E to Palm Springs Museum, CA, USA; now at March AFB Museum, CA, USA
1102	MiG-21F-13	161102	8-12-71	1. SLP	**MiG-21FR**, scrapped at Prešov 2-2-1990
1103 Black	MiG-21F-13	161103	8-12-71	1. SLP	**MiG-21FR**, 1. LŠP, silver overall. Decommissioned 1991, bought by Mr. Sedláček in 1992, now in Le Bourget Museum, Paris, France
1104	MiG-21F-13	161104	6-3-72	1. SLP	**MiG-21FR**, 1. LŠP, ferried from Přerov to Vodochody 20-5-1991 and decommissioned, sold 13-7-1994 to LOK, resold 18-11-1994 in Ann Arbor, MI, USA
1105	MiG-21F-13	261105	17-2-72	9. SLP	**MiG-21FR**, 4. SLP, written off 24-5-1977 Pardubice after accident
1106 Black	MiG-21F-13	161106	18-1-72	8. SLP	**MiG-21FR**, 1. SLP, silver overall. Noted at Vodochody 19-6-1992, currently preserved Vyškov Museum
1107	MiG-21F-13	261107	8-4-72	9. SLP	**MiG-21FR**, 4. SLP, crashed 23-2-1989 at LOK
1108	MiG-21F-13	261108	19-4-72	1. SLP	**MiG-21FR**, 1. LŠP, ferried from Přerov to Vodochody and decommissioned 20-3-1991, sold 11-7-1994 to LOK, resold 9-11-1994 in Oregon, USA, registered N6285D in 1996 by Marlo Treit, in 2000 with K.C.Chase Jr., Rochester, MN, USA
1109	MiG-21F-13	261109	19-4-72	1. SLP	**MiG-21FR**, 1. LŠP, ferried from Přerov to Vodochody and decommissioned 8-4-1991, sold 11-7-1994 to LOK, resold 9-11-1994 in Oregon, USA, registered N6285L in 1996 by Marlo Treit, now with Jet Chevrolet Inc., Federal Way, WA, USA
1110	MiG-21F-13	261110	18-4-72	5. SLP	**MiG-21FR**, 1. LŠP, decommissioned 1991, later probably scrapped
1111 Black	MiG-21F-13	261111	8-6-72	5. SLP	**MiG-21FR**, 4. SLP, 1. LŠP. silver overall. Decommissioned 1991 Přerov, now pres, Vyškov Museum
1112	MiG-21F-13	261112	8-6-72	5. SLP	**MiG-21FR**, 4. SLP, 1. LŠP, ferried from Přerov to Vodochody and decommissioned 22-3-1991, sold 13-7-1994 to LOK, resold 11-1994 to Dr Stefan Hornak, Palm Springs, CA, USA, despatched 16-3-1995
1113	MiG-21F-13	261113	8-7-72	5. SLP	**MiG-21FR**, crashed Plzeň-Líně 9-4-1980
1114	MiG-21F-13	261114	14-7-72	9. SLP	**MiG-21FR**, 4. SLP, 1. SLP, 1. LŠP, ferried from Přerov to Vodochody and decommissioned 8-4-1991, sold 12-7-1994 to LOK, resold 18-11-1994 in Ontario, Canada, sold again 2-1997 as N221YA in Niagara, NY, USA, then to Yak Amerika Corp., St Louis, MO, USA
9901	MiG-21F-13	269901	21-8-62	VSL	Transferred to Syria 1973
9902 Black	MiG-21F-13	269902	5-11-62	VSL	Silver overall. Transferred to Syria 1973
9903 Black	MiG-21F-13	269903	22-4-63	VSL	Silver overall. Transferred to Syria 1973
9904 Black	MiG-21F-13	269904	13-4-63	VSL	Silver overall. Earmarked for Syria 1973 but used instead as ground instructional airframe Prešov, allocated to Slovakia, preserved 2002 Košice Airport Museum

via RART

▲
'7711 Black' was one of six 9. SBoLP MiG-21MFs to be painted in the colours of the 'Delta' aerobatic team in 1992. The letters 'LS' on the rudder denote *Letece Strely* (Flying Arrows).

auxiliary air intakes to protect them from being blasted open when the cannon was fired were not installed when built and were fitted after delivery to the CzAF. Another important feature that was not initially included was the rear view periscope on the canopy.

It was subsequently discovered that the MiG-21Ms were underpowered. To redress this shortcoming, their R11F2S-300 engines rated at 6,175 kgp (13,610 lbst) in afterburner mode were replaced whilst in service by the R13-300 with an afterburner rating of 6,490 kgp (14,310 lbst). The reengined aircraft were given the local designation **MiG-21MA** and the main visual difference compared with the MiG-21MF was the slightly different shape of the airbrakes.

Some MiG-21MAs and MiG-21MFs, marked **ECM** in the tables on pages 519-523, were given the capability of carrying the SM electronic countermeasures pod on the centreline pylon.

In the tables below, 4. SSLT, 81. SSLT and 82. SSLT denotes Independent Fighter Squadrons (*Samostatná Stíhací Letka*). The 82. SSLT was based at Mošnov.

The Czechoslovak Air Force did not use the ultimate fighter variant, the MiG-21*bis*, contenting itself instead with the MiG-21MF (*izdeliye* 96F) until the MiG-23MF became available. Developed from the MiG-21M, the MiG-21MF had the more powerful R13-300 engine and RP-22 Sapfir-21 radar. The MiG-21MA had the same engine but carried the older RP-21MA Sapfir-21 radar. Altogether 102 MiG-21MFs were delivered and when new, equipped 1. SLP, 4. SLP and 6. SBoLP in substantial numbers and four went to 5. SLP.

Gor'kiy-built examples fitted with MiG-21*bis*-style instrument panels were unofficially called MiG-21MF-75 by the CzAF and are marked * in the table on pages 520-523. Ten aircraft refitted with NATO standard avionics in 1999-2000 and redesignated locally **MiG-21MFN**, are thus indicated in the Comments column following the unit to which they belonged at that time.

After the Velvet Revolution of 1989, which was followed in 1991 by the dissolution of the Soviet Union, the Czechoslovak armed forces suffered a dramatic reduction in personnel,

In 1997 Czech Air Force/4. SSLT MiG-21MF '7701' received this experimental disruptive camouflage scheme extending even to the radome. The national insignia and the serial are hardly readable at all.
▼

Jan Cadil

Czechoslovak Air Force MiG-21MF, 81. SSLT, with a quick-identification stripe applied for a NATO *Co-operative Key* exercise

Czech Air Force MiG-21MF, 11. SLP

Czechoslovak Air Force MiG-21MF, 9. SBoLP, 'Delta' aerobatic team, 1992

Czechoslovak Air Force MiG-21PFs

0301 Black	MiG-21PF	760301	30-5-1964	1. SLP	8. SLP, silver overall. Written off Mošnov 28-6-1985 after accident
0302	MiG-21PF	760302	6-1964	8. SLP	9. SLP, to VM VHÚ 5-1989, decommissioned and stored there 8-2-1989
0303	MiG-21PF	760303	1964	8. SLP	Written off 30-8-1965 Mošnov after accident
0304	MiG-21PF	76304	1964		Written off 26-10-1971 after accident
0305	MiG-21PF	760305	1964	8. SLP	Written off 4-12-1965 after accident at Mošnov
0306	MiG-21PF	760306	6-1964	8. SLP	Although written off 19-5-1989 was at VLU Prešov in 1993, allocated to Slovakia, now stored Trenčín for Military Museum Piešťany
0307	MiG-21PF	760307	1964		Damaged beyond repair Pardubice in landing accident 5-4-1967 with Aero Vodochody pilot and written off
0308 Black	MiG-21PF	760308	1964	1. SLP	8. SLP, silver overall, unit badge on port side. Decommissioned 29-5-1989 Bechyně, now preserved VM VHÚ
0309 Black	MiG-21PF	760309	6-1964	1. SLP?	8. SLP, written off 8-2-1990, moved first to VM VHÚ store, then preserved Zruč Air Park
0310	MiG-21PF	760310	7-1964		8. SLP, 9. SLP, written off 25-5-1990, handed over to Aeroklub Soběslav, later sold to Austria
0401	MiG-21PF	760401	7-1964		8. SLP, 9. SLP, 8. SLP, decommissioned 8-5-1990 at Bechyně
0402	MiG-21PF	760402	7-1964	1. SLP?	8. SLP, decommissioned 8-2-1990 at VLU Prešov
0403	MiG-21PF	760403	7-1964	1. SLP	8. SLP, decommissioned 18-12-1989 and ferried to Přerov, sold to JZD Slušovice, resold to motel Všenina, now at Zorgvlied, Holland
0404	MiG-21PF	760404	7-1964	1. SLP	8. SLP, 9. SLP, decommissioned 12-12-1989 and ferried to Přerov, sold to JZD Slušovice, located at motel Všenina, now at Zelhem, Holland
0405	MiG-21PF	760405	7-1964	1. SLP	Written off České Budějovice 23-6-1990 after accident

0807	MiG-21PF	760807	1964	11. SLP	8. SLP, decommissioned 18-1-1989
0809	MiG-21PF	760809	2-1965	8. SLP	Decommissioned 8-2-1990 at České Budějovice
0810	MiG-21PF	760810	2-1965	11. SLP	8. SLP, decommissioned 17-8-1989 and scrapped Prešov 1-2-1991
0812	MiG-21PF	760812	2-1965	8. SLP	9. SLP, written off 11-1989 or 25-5-1990, handed over to Aeroklub Soběslav, sold to Arnhem-Deelen Museum, Holland
0912	MiG-21PF	760912	12-1964	8. SLP	Not flown since the end of 1989, decommissioned and moved to Přerov 1991, where scrapped 12-1992
1212 Black	MiG-21PF	761212	11-1964	1. SLP	8. SLP, 9. SLP, 8. SLP, silver overall, twin red stripes on tail. From end of 1989 non-flying, 1991 moved to Přerov and written off, 1993 preserved Vyškov Museum
1213	MiG-21PF	761213	4-1965	1. SLP	8. SLP, 9. SLP, 8. SLP, not flown since the end of 1989, decommissioned and moved to Přerov 1991, scrapped 3-1993
1214	MiG-21PF	761214	4-1965	1. SLP	8. SLP, not flown since the end of 1989, decommissioned and moved to Přerov 1991, scrapped 12-1992
1215	MiG-21PF	761215	4-1965	1. SLP	8. SLP, written off 24-5-1989, ground training airframe 1992-3 VLU Prešov, allocated to Slovakia, 10-1994 to Košice, now stored Trenčín for Military Museum Piešťany
1301 Black	MiG-21PF	761301	4-1965	1. SLP?	8. SLP, silver overall. Decommissioned 1990 at České Budějovice
1302	MiG-21PF	761302	4-1965	11. SLP	8. SLP, decommissioned VLU Prešov 8-2-1990, scrapped 4-1990 or 5-1990
1303	MiG-21PF	761303	4-1965	11. SLP	8. SLP, not flown since the end of 1989, decommissioned and moved to Přerov 1991, scrapped 3-1993
1304	MiG-21PF	761304	4-1965	8. SLP	Decommissioned 1-8-1990, ferried to UK 10-9-1990 for RAF Benevolent Fund, sold in USA as N5179Y, now with Onesource Financial Holdings, Newark, DE, USA
1305	MiG-21PF	761305	4-1965	11. SLP	Crashed Žatec 29-9-1972, but also reported preserved and stored VM VHÚ
1306	MiG-21PF	761306	4-1965	1. SLP	8. SLP, decommissioned 8-2-1990
1307	MiG-21PF	761307	4-1965	8. SLP	Written off 8-2-1990, preserved 1992 Prešov, Museum, Slovakia

1308 Black	MiG-21PF	761308	4-1965	11. SLP	9. SLP, silver overall. Decommissioned 18-8-1989 and moved to VAAZ, Brno as ground instructional airframe, now displayed Brno-Slatina Airport
1309	MiG-21PF	761309	4-1965	8. SLP	Decommissioned 1-8-1990, stored VM VHÚ, sold 1993 as N121MG, now with Airmarc Inc., Wheaton, IL, USA
1310	MiG-21PF	761310	4-1965	11. SLP	Written off 11-1-1975 Žatec after accident
1311 Black	MiG-21PF	761311	4-1965	8. SLP	Silver overall. Written off 18-1-1989, preserved Vyškov Museum, now Hradec Králové
1312	MiG-21PF	761312	4-1965	8. SLP	Decommissioned 8-2-1990
1313 Black	MiG-21PF	761313	4-1965	8. SLP	Silver overall. Non-flying since end of 1989; 1991 moved to Přerov and written off, 1993 preserved Vyškov Museum
1314	MiG-21PF	761314	4-1965	8. SLP	Written off Brno 13-10-1989 after accident
1315	MiG-21PF	761315	4-1965	8. SLP	Crashed 12-11-1974 at Mošnov

Czechoslovak Air Force MiG-21PFMs

Serial	Version	C/n	Delivery date	First unit	Comments
4311	MiG-21PFM (*izd.* 94A)	94A4311	8-1966	1. SLP	Written off 6-1-1970 after collision with MiG-21PFM 4312 over České Budějovice
4312	MiG-21PFM (*izd.* 94A)	94A4312	8-1966	1. SLP	Crashed 6-1-1970, after collision with MiG-21PFM 4311 over České Budějovice
4315	MiG-21PFM (*izd.* 94A)	94A4315	11-11-66	1. SLP	11. SLP, decommissioned 21-3-1991 at Žatec and moved to Vodochody, on 11-7-1994 to LOK, sold 17-10-1994 to Champlin Fighter Museum, now at Commemorative Air Force Museum, Phoenix, AZ, USA
4401 Black	MiG-21PFM (*izd.* 94A)	94A4401	8-1966	1. SLP	11. SLP, silver overall. Decommissioned 15-5-1990, gate guard at CzAF HQ, Stará Boleslav
4402	MiG-21PFM (*izd.* 94A)	94A4402	30-8-66	11. SLP	Decommissioned 21-3-1991 at Žatec and moved to Vodochody, on 12-7-1994 to LOK, sold to client in Oregon, USA, 22-11-1994
4403	MiG-21PFM (*izd.* 94A)	94A4403	8-1966	1. SLP	Written off České Budějovice 1-6-1968 after accident
4404	MiG-21PFM (*izd.* 94A)	94A4404	8-1966	1. SLP	11. SLP, 8. SLP, decommissioned 9-7-1990 probably at České Budějovice Repair Plant, rear fuselage used to repair MiG-21MA '1207', remainder scrapped 6-1993
4405 Black	MiG-21PFM (*izd.* 94A)	94A4405	18-8-66	1. SLP	11. SLP, silver overall. Decommissioned 21-3-1991 at Žatec and moved to Vodochody, on 4-1-1994 to LOK, then 16-2-1994 to Austria, now preserved Bad Ischl, Austria
4406	MiG-21PFM (*izd.* 94A)	94A4406	11-1966	9. SLP	8. SLP, 11. SLP, decommissioned 20-3-1991 at Žatec and moved to Vodochody, transferred 29-3-1994 LOK, then sold 25-11-1994 to Lafayette Museum, Orange, then to Orange Base Museum, France
4407	MiG-21PFM (*izd.* 94A)	94A4407	11-1966	9. SLP	8. SLP, 11. SLP, 8. SLP, 11. SLP, decommissioned 31-8-1990 at Žatec, sold to LOK, then to a buyer, de Kolonien, in Belgium
4408	MiG-21PFM (*izd.* 94A)	94A4408	11-1966	9. SLP	8. SLP, 11. SLP, written off Žatec 5-8-1978 after accident
4409	MiG-21PFM (*izd.* 94A)	94A4409	11-1966	9. SLP	8. SLP, 11. SLP, decommissioned Žatec 20-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 3-7-1993, stored there and later scrapped
4410 Black	MiG-21PFM (*izd.* 94A)	94A4410	11-1966	9. SLP	8. SLP, 11. SLP when this regiment received the honorary title *Invazni* (Invasion Regiment) this aircraft boasted a blue fuselage spine and canopy frame plus a blue/red/white vertical tail and a red band with white stars around the centre fuselage. Decommissioned Žatec 19-3-1991 and flown to Vodochody where scrapped 16-8-1994
4411 Black	MiG-21PFM (*izd.* 94A)	94A4411	11-1966	9. SLP	8. SLP, 11. SLP, silver overall, unit badge on port side. Decommissioned 31-8-1990 at Žatec, preserved at VM VHÚ
4412	MiG-21PFM (*izd.* 94A)	94A4412	11-1966	9. SLP	8. SLP, 11. SLP, crashed 2-11-1988
4413	MiG-21PFM (*izd.* 94A)	94A4413	11-1966	9. SLP	8. SLP, 11. SLP, decommissioned Žatec 27-3-1991 and flown to Vodochody, allocated to Slovakia, 23-7-1993 flown to Sliač, stored there and later scrapped
4414	MiG-21PFM (*izd.* 94A)	94A4414	11-1966	9. SLP	8. SLP, 11. SLP, allocated to Slovakia and moved to Sliač 23-7-1993, stored there and later scrapped
4415	MiG-21PFM (*izd.* 94A)	94A4415	11-1966	9. SLP	8. SLP, 11. SLP, allocated to Slovakia and moved to Sliač 23-7-1993, now preserved at Military Museum Piešťany
4608	MiG-21PFM (*izd.* 94A)	94A4608	12-1966	1. SLP	11. SLP, crashed 21-4-1988
4609 Black	MiG-21PFM (*izd.* 94A)	94A4609	9-1966	1. SLP	11. SLP, silver overall, unit badge on port side. Decommissioned 31-8-1990 at Žatec, preserved stored at VM VHÚ
5406	MiG-21PFM (*izd.* 94A)	94A5406	7-1967	1. SLP	8. SLP, 11. SLP, decommissioned Žatec 20-3-1991 and flown to Vodochody
5407	MiG-21PFM (*izd.* 94A)	94A5407	7-1967	1. SLP	8. SLP, 11. SLP, decommissioned Žatec 20-3-1991 and flown to Vodochody
5408	MiG-21PFM (*izd.* 94A)	94A5408	7-1967	1. SLP	Destroyed by fire at line-up point 6-1-1972 after engaging afterburner for take-off
5409	MiG-21PFM (*izd.* 94A)	94A5409	7-1967	1. SLP	11. SLP, decommissioned Žatec 21-3-1991, flown to Vodochody, sold 30-5-1994 to private owner

5410	MiG-21PFM (*izd.* 94A)	94A5410	7-1967	9. SLP	8. SLP, 11. SLP, decommissioned Žatec 20-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 3-7-1994, stored there and later scrapped
5411	MiG-21PFM (*izd.* 94A)	94A5411	7-1967	9. SLP	8. SLP, 11. SLP, decommissioned Žatec 20-3-1991 and ferried from LOK to Vodochody, sold to Museum of Flight, Seattle, WA, USA
7113	MiG-21PFM (*izd.* 94A)	94A7113	2-4-68	11. SLP	Decommissioned Žatec 20-3-1991 and flown to Vodochody where scrapped 17-5-1994
7114	MiG-21PFM (*izd.* 94A)	94A7114	9-4-68	8. SLP	11. SLP, decommissioned Žatec 21-3-1991 and flown to Vodochody where scrapped 11-5-1994
7115	MiG-21PFM (*izd.* 94A)	94A7115	4-1968	11. SLP	Written off Žatec 28-5-1983 after accident
7201	MiG-21PFM (*izd.* 94A)	94A7201	27-3-91	1. SLP?	8. SLP, decommissioned Brno 27-3-1991 and flown to Vodochody where scrapped 24-5-1994
7202	MiG-21PFM (*izd.* 94A)	94A7202	4-1968	8. SLP	Decommissioned Brno 27-3-1991 and flown to Vodochody where scrapped 4-5-1994
7203	MiG-21PFM (*izd.* 94A)	94A7203	4-1968	1. SLP?	8. SLP, decommissioned Brno 27-3-1991 and flown to Vodochody where scrapped 11-5-1994
7204	MiG-21PFM (*izd.* 94A)	94A7204	4-1968	8. SLP	Decommissioned Brno 27-3-1991 and flown to Vodochody where scrapped 16-8-1994
7205	MiG-21PFM (*izd.* 94A)	94A7205	4-1968	11. SLP	Retained by LOK as pattern aircraft after first medium overhaul, later moved to VLU Prešov, where scrapped 31-10-1990
7206	MiG-21PFM (*izd.* 94A)	94A7206	4-1968	11. SLP	Decommissioned Žatec 20-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 3-7-1994, stored there and later scrapped
7207	MiG-21PFM (*izd.* 94A)	94A7207	31-5-68	11. SLP	Decommissioned Žatec 20-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 3-7-1994, stored there and later scrapped
7208	MiG-21PFM (*izd.* 94A)	94A7208	4-1968	11. SLP	Decommissioned Žatec 21-3-1991 and flown to Vodochody, where scrapped 4-5-1994
7209	MiG-21PFM (*izd.* 94A)	94A7209	4-1968	11. SLP	Decommissioned Žatec 21-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 3-7-1994, stored there and later scrapped
7906	MiG-21PFM (*izd.* 94A)	94A7906	7-1968?	9. SLP	Written off Bechyně 15-2-1972 after accident
7907	MiG-21PFM (*izd.* 94A)	94A7907	7-1968	9. SLP	1. SLP, 11. SLP, written off Žatec 11-8-1981
7908	MiG-21PFM (*izd.* 94A)	94A7908	7-1968	9. SLP	1. SLP, 8. SLP, decommissioned 27-3-1991, Brno, and ferried to Vodochody, allocated to Slovakia and moved to Sliač 25-6-1993, on 23-7-1994 stored Trenčín for Military Museum Piešťany
7909	MiG-21PFM (*izd.* 94N)	94N7909	29-1-69	9. SLP	1. SLP, 11. SLP, decommissioned Žatec 20-3-1991 and flown to Vodochody where scrapped 21-7-1994
7910 Black	MiG-21PFM (*izd.* 94N)	94N7910	2-8-68	9. SLP	1. SLP, 11. SLP, silver overall. Decommissioned Žatec 19-3-1991 and flown to Vodochody allocated to Slovakia and moved to Sliač 3-7-1993 (or 23-7-1994), stored there and later scrapped
7911	MiG-21PFM (*izd.* 94N)	94N7911	8-1968?	9. SLP	1. SLP, 11. SLP, 8. SLP, written off 11-4-1984 Mošnov after accident
7912	MiG-21PFM (*izd.* 94N)	94N7912	8-1968	9. SLP	1. SLP, 11. SLP, 8. SLP, decommissioned Žatec 27-3-1991 and flown to Vodochody where scrapped 28-4-1994
7913 Black	MiG-21PFM (*izd.* 94N)	94N7913	24-8-68	9. SLP	1. SLP, 11. SLP, silver overall with yellow band around rear fuselage. Decommissioned Žatec 21-3-1991, allocated to Slovakia and moved to Sliač 3-7-1994, now preserved Martin Museum, Slovakia
7914	MiG-21PFM (*izd.* 94N)	94N7914	5-9-68	9. SLP	1. SLP, 11. SLP, decommissioned Žatec 20-3-1991 and flown to Vodochody where scrapped 28-4-1994
7915	MiG-21PFM (*izd.* 94N)	94N7915	8-1968	9. SLP	Crashed 16-3-1970
8001 Black	MiG-21PFM (*izd.* 94N)	94N8001	8-1968	9. SLP	1. SLP, 8 SLP, 11. SLP, silver overall. Decommissioned 19-3-1991 at Žatec, preserved 12-10-1994 Vyškov Museum
8002	MiG-21PFM (*izd.* 94N)	94N8002	8-1968	9. SLP	1. SLP, 11. SLP, decommissioned Žatec 20-3-1991 and flown to Vodochody, where scrapped 11-5-1994

number of bases and quantity of equipment. Further reorganisations took place after Czechoslovakia (then known as the Czecho-Slovak Federal Republic) split into the Czech Republic and the Slovak Republic on 1st January 1993. The CzAF's aircraft fleets were divided between them 2 to 1 respectively.

Subsequently in 1994 the regimental system was abolished. Instead of regiments (*pluk*) five Air Bases (*základna*) were formed in the Czech Republic, retaining squadrons (*letka*) within each base.

On 1st November 1997 the CzAF was once more subordinated to the Army, becoming officially the **Air Force of the Army of the Czech Republic** (*Vzdušné Síly Armady Českej Republiky*). The two Air Armies were replaced by two Corps.

No doubt because of lower operating costs, the MiG-21MF remained in service in the Czech Republic after the MiG-23MF and MiG-29 were retired. In fact the last MiG-21MF was only withdrawn from service in 2005 after the arrival of 14 leased SAAB JAS 39C/D Gripen fighters.

The new organisation is illustrated below for Čáslav Tactical Air Base No. 4:

4. *Základna Taktickeho Letectva* (Tactical Air Base, ZTL), Čáslav;

• 41. *Stíhací Letka* (Fighter Squadron, SLT) '*Tigrí*' (Tigers);

Czechoslovak/Czech Air Force MiG-21Rs					
Serial	**Version**	**C/n**	**Delivery date**	**First unit**	**Comments**
1501 Black	MiG-21R	94R01501	1-1-1969	47. PZLP	28. SBoLP, from 1994 onwards 'Stress Team', LZO, dark green/dark earth camouflage, black/white chequered rudder, black/white 'teeth' around intake perimeter. Decommissioned 1995 and presented to VM VHÚ, on display with Type R PHOTINT pod
1502	MiG-21R	94R01502	31-1-69	47. PZLP	4-11-1992 allocated to Slovakia and ferried from 47. PZLP, Hradec Králové, to Malacký-Kuchyňa, Slovakia, decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, now stored Trenčín for Military Museum Piešťany
1624	MiG-21R	94R01624	7-1969	47. PZLP	Written off 21-9-1971 Pardubice after being damaged in accident
1625	MiG-21R	94R01625	1-7-1969	47. PZLP	28. SBoLP, 6-1994 decommissioned and placed in storage at Plzeň-Líně
1701	MiG-21R	94R01701	1-7-1969	47. PZLP	28. SBoLP, 9-1993 decommissioned and placed in storage at Plzeň-Líně, reported scrapped 1993
1702	MiG-21R	94R01702	16-7-69	47. PZLP	4-11-1992 ferried from 47. PZLP, Hradec Králové, to Malacký-Kuchyňa, Slovakia, decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, stored Trenčín for Military Museum Piešťany
1703	MiG-21R	94R01703	31-12-69	47. PZLP	4-11-1992 ferried from 47. PZLP, Hradec Králové, to Malacký-Kuchyňa, Slovakia, decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, now preserved Košice Museum, Slovakia
1704	MiG-21R	94R01704	1-7-1969	47. PZLP	28. SBoLP, decommissioned 6-1994 and placed in storage at Plzeň-Líně, reported scrapped
1824	MiG-21R	94R01824	1-6-1971	47. PZLP	28. SBoLP, decommissioned 5-1994 and placed in storage at Plzeň-Líně, reported scrapped
1903	MiG-21R	94R01903	1-6-1971	47. PZLP	28. SBoLP, decommissioned 6-1994 and placed in storage at Plzeň-Líně. Currently preserved Caen, France, as Soviet Air Force '45'
1904	MiG-21R	94R01904	1-6-1971	47. PZLP	28. SBoLP, decommissioned 5-1994 and placed in storage at Plzeň-Líně. Currently N7803Z of Vulcan Warbirds Inc., Seattle, WA, USA
1918	MiG-21R	94R01918	28-4-70	47. PZLP	4-11-1992 ferried from 47. PZLP, Hradec Králové, to Malacký-Kuchyňa, decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, now stored Trenčín for Military Museum Piešťany
1919	MiG-21R	94R01919	5-1970	47. PZLP	Written off Pardubice 21-7-1972 after being damaged in accident
1920	MiG-21R	94R01920	28-4-70	47. PZLP	4-11-1992 ferried from 47. PZLP, Hradec Králové, to Malacký-Kuchyňa, Slovakia, decommissioned 31-12-1992 and since 1-1-1993 Slovak AF
1921	MiG-21R	94R01921	18-3-70	47. PZLP	Written off Pardubice 1-7-1976 after being damaged in accident
1922	MiG-21R	94R01922	28-4-70	47. PZLP	4-11-1992 ferried from 47. PZLP, Hradec Králové, to Malacký-Kuchyňa, Slovakia, decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, now stored Trenčín for Military Museum Piešťany
1923 Black	MiG-21R	94R01923	11-6-71	47. PZLP	Silver overall. 4-11-1992 ferried from 47. PZLP, Hradec Králové, to Malacký-Kuchyňa, Slovakia, decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, now preserved Košice Museum, Slovakia
1924	MiG-21R	94R01924	23-5-70	47. PZLP	4-11-1992 ferried from 47. PZLP, Hradec Králové, to Malacký-Kuchyňa, Slovakia, decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, stored Trenčín for Military Museum Piešťany
2058	MiG-21R	94R02058 or 021058	12-1971	47. PZLP	Written off Pardubice 8-11-1973 after being damaged in accident
2066	MiG-21R	94R02066 or 0200066	12-1971	47. PZLP	28. SBoLP, decommissioned 6-1994 and placed in storage at Plzeň-Líně. Currently registered as N80634 for G.D.Hickman, Gordo, AL, USA
2083	MiG-21R	94R02083 or 020083	31-10-71	47. PZLP	Crashed 18-8-1975
2101 Black	MiG-21R	94R02101 or 021001	1-12-1971	47. PZLP	28 SBoLP, silver overall. Decommissioned 5-1994 and flown to Přerov, subsequently sold and preserved at Vyškov Museum
2109	MiG-21R	94R02109 or 021009	1-12-1971	47. PZLP	28. SBoLP, decommissioned 5-1994 and placed in storage at Plzeň-Líně. Currently preserved at the Stafford Air and Space Museum, Weatherford, OK, USA as Soviet Air Force '15'
2133 Black	MiG-21R	94R02133 or 021033	1-12-1971	47. PZLP	28. SBoLP, silver overall. Decommissioned 5-1994 and placed in storage at Plzeň-Líně. Currently N80639 for S.M.Rosenberg of Novato, CA, USA
2149 Black	MiG-21R	94R02149 or 021049	1-12-1971	47. PZLP	From 1994 onwards 'Stress Team', 28. SBoLP, LZO, silver overall. Decommissioned 1-1995 as the last airworthy MiG-21R in the Czech Republic and placed in storage at Plzeň-Líně. Currently derelict (?) at Planes of Fame Museum, Chino, CA, USA

- 42. SLT '*Pegaz*' (Pegasus);
- 43. SLT '*Vlky*' (Wolves)

32. ZTL, later 21. ZTL, Čáslav

- 211. *Tactická Letka* (Tactical Squadron, TL), Čáslav

The first trainer variant operated in Czechoslovakia was the MiG-21U (*izdeliye* 66-400) with the narrow-chord tail and ventral parabrake. Three examples arrived in April 1965, two going to 1. LŠP and one to 9. SLP.

Czechoslovak/Czech Air Force MiG-21Ms					
Serial	**Version**	**C/n**	**Delivery date**	**First unit**	**Comments**
1112 Black	MiG-21M	961112	17-7-69	4. SLP	5. SLP, 1. LŠP, 82. SSLT, silver overall. Allocated to Slovakia and flown to Malacký-Kuchyňa 21-11-1992 to join the Slovak Air Force on 1-1-1993, noted 2006 stored Piešťany
1113 Black	MiG-21M	961113	17-7-69	4. SLP	5. SLP, 1. LŠP, 82. SSLT, silver overall, pin-up nose art. Allocated to Slovakia and flown to Malacký-Kuchyňa 21-11-1992 to join the Slovak Air Force on 1-1-1993, noted 2006 stored Piešťany
1114 Black	MiG-21M	961114	17-7-69	4. SLP	5. SLP, 1. LŠP, 82. SSLT, silver overall. Allocated to Slovakia and flown to Malacký-Kuchyňa 21-11-1992 to join the Slovak Air Force on 1-1-1993, noted 2006 stored Sliač
1115	MiG-21M	961115	17-7-69	4. SLP	Written off 26-3-1973 Pardubice after accident damage
1201	MiG-21M	961201	17-7-69	4. SLP	5. SLP, 1. LŠP, 82. SSLT, allocated to Slovakia and joined the Slovak Air Force on 1-1-1993, noted 2006 stored Sliač
1202	MiG-21M	961202	17-7-69	4. SLP	47. PZLP, written off 8-11-1982 Pardubice after accident damage
1203 Black	MiG-21M	961203	17-7-69	4. SLP	47. PZLP, 4. SLP, 5. SLP, 82. SSLT, silver overall. Allocated to Slovakia and flown to Malacký-Kuchyňa 21-11-1992 to join the Slovak Air Force on 1-1-1993, noted 2006 stored Sliač
1204	MiG-21M	961204	7-1969	4. SLP	Written off 12-8-1970 Pardubice after accident damage
1205	MiG-21M	961205	7-1969	4. SLP	47. PZLP, 4. SLP, 5. SLP, written off Plzeň-Líně 22-4-1991 due to damage after mid-air collision with MiG-21M '1207'
1206	MiG-21M	961206	17-7-69	4. SLP	**ECM**, 47. PZLP, 4. SLP, 5. SLP, 1. LŠP, 82. SSLT, allocated to Slovakia and flown to Malacký-Kuchyňa 21-11-1992 to join the Slovak Air Force on 1-1-1993, noted stored there 2001, some sources state noted 2005 preserved Ocova
1207	MiG-21M	961207	7-1969	4. SLP	47. PZLP, 4. SLP, 5. SLP, 1. LŠP. Damaged 22-4-1991 in mid-air collision with 1205 but managed to land at Plzeň-Líně; repaired České Budějovice Repair Plant using rear fuselage of MiG-21PFM '4404'. To 1. LŠP; damaged again landing Přerov 4-2-1992 and sold to LOK, now preserved Zruč Air Park
1208	MiG-21M	961208	17-7-69	4. SLP	47. PZLP, 4. SLP, 5. SLP, 1. LŠP, 82. SSLT; allocated to Slovakia and flown to Malacký-Kuchyňa 20-11-1992 to join the Slovak Air Force on 1-1-1993, noted 2005 stored there
1209	MiG-21M	961209	7-1969	4. SLP	**ECM**, 47. PZLP, 4. SLP, 9. SLP, 9. SBoLP; allocated to Slovakia and flown to Malacký-Kuchyňa 12-11-1992 to join the Slovak Air Force on 1-1-1993, now preserved Košice Museum
1210	MiG-21M	961210	17-7-69	4. SLP	**ECM**, 47. PZLP, 4. SLP, 9. SLP, 9. SBoLP, 5. SLP. Allocated to Slovakia and flown to Malacký-Kuchyňa 20-11-1992, 1. LŠP, 82. SSLT, then to Sliač 27-10-1992; decommissioned 21-12-1992, now preserved Košice Museum
2613	MiG-21M	962613	6-1970	4. SLP	Written off 15-4-1988 Pardubice after accident damage
2614	MiG-21M	962614	13-6-70	4. SLP	5. SLP, 1.SLP, 28. SBoLP, 1. LŠP, 4. zSL PVO-43. SLT, 4. zTL. Decommissioned 7-1997 to 12-1997, last MiG-21MA in Czech service, noted 2007 stored Čáslav
2615 Black	MiG-21M	962615	6-1970	4. SLP	5. SLP, 1. LŠP, 82. SSLT, silver overall. Allocated to Slovakia, probably flown there 10-12/1992 to join the Slovak AF on 1-1-1993, noted 2006 stored Sliač
2701	MiG-21M	962701	6-1970	4. SLP	10-1985 ground instructional airframe at VLU Prešov, 6 or 7-1988 back to 4. SLP, then to 5. SLP, finally 11. SLP, 5 to 8-1993 decommissioned to become ground instructional airframe at Brno Military Academy, noted 2005
2702	MiG-21M	962702	6-1970	4. SLP	Written off 2-4-1981 Pardubice after accident damage
2703 Black	MiG-21M	962703	6-1970	4. SLP	5. SLP, 1. LŠP, decommissioned 9 to 11-1993 and put into storage probably at Plzeň-Líně, now preserved Vyškov Museum, silver overall
2704	MiG-21M	962704	6-1970	4. SLP	9. SLP, written off Bechyně 12-6-1991 after accident damage, became ground instructional airframe at VLU Prešov
2705	MiG-21M	962705	6-1970	4. SLP	9. SLP, 9. SBoLP, 81. SSLT, allocated to Slovakia and flown to Sliač 6-1992 to join the Slovak Air Force on 1-1-1993, noted 2003 stored Sliač, probably now scrapped
2706	MiG-21M	962706	6-1970	4. SLP	**ECM**, 9. SLP, 9. SBoLP, 81. SSLT, allocated to Slovakia and flown to Sliač 6-1992 to join the Slovak Air Force on 1-1-1993, 81. SSLT, noted 2006 stored Sliač
2707	MiG-21M	962707	6-1970	4. SLP	9. SLP, 9. SBoLP, allocated to Slovakia and flown to Sliač 23-10-1992 to join the Slovak Air Force on 1-1-1993, now preserved Košice Museum

Further deliveries were of the MiG-21U (*izdeliye* 66-600) with the larger tail and parabrake container below the rudder; eight arrived between March 1966 and September 1967. Six of these went straight to Přerov for 1. LŠP plus one to 1. SLP and the other to 4. SLP.

Czechoslovak/Czech Air Force MiG-21MFs

Serial	Version	C/n	Manufact. date	Delivery date	First unit	Comments
2205 Black	MiG-21MF*	96002205	24-6-75	2-7-75	1. SLP	4. SLP, 9. SLP, 9. SBoLP; overall grey scheme and 1992 painted in 'Delta' aerobatic team colours with tail number '9'. 11. SLP, 82. SSLT, 4. SSLT, became **MiG-21MFN** 1999-2000, grey overall and no special markings any more; 42. SLT?, 41. SLT?, 211. TL?. Decommissioned 7-2005, stored Přerov, noted 2006
2410	MiG-21MF*	96002410	24-6-75	2-7-75	1. SLP	4. SLP, 9. SLP, 9. SBoLP and 1992 painted in 'Delta' aerobatic team colours, 82. SSLT, withdrawn from service 9-1993 and placed in storage at Plzeň-Líně, but now preserved in VM VHÚ store
2500 Black	MiG-21MF*	96002500	25-6-75	2-7-75	1. SLP	4. SLP, 9 SLP, 9. SBoLP and 1992 painted in 'Delta' aerobatic team colours, 82. SSLT, stored Plzeň-Líně approx. 1995-98, then at LZO Líně and České Budějovice, became **MiG-21MFN** 1999-2000, 41. SLT, 22. SLP; from 10-2002 painted grey overall as '2500 Grey' with '45 years of fighter operations Čáslav/22. SLP' titles, tiger nose art and grey tiger stripes on tail. Decommissioned 28-5-2005 and stored Přerov where noted 2006
3008	MiG-21MF*	96003008	25-6-75	2-9-75	1. SLP	4. SLP, 9. SLP, 82. SSLT, stored at Plzeň-Líně from 9-1993 and then at LZO Líně and České Budějovice, became **MiG-21MFN** 1999-2000, 41. SLT, crashed 10-10-2000
4003 Black	MiG-21MF*	96004003	29-7-75	17-9-75	1. SLP	5 SLP, 9. SLP, 82. SSLT, 9-1993 to 2000 at Plzeň-Líně Aircraft Repair Plant, became **MiG-21MFN** in 2000, grey overall, later special colours with MiG-21F-13 silhouette in silver on grey and tiger-striped rudder and stabilators. 41. SLT, 9. SBoLP, 211. TL, withdrawn from service 5-2005 and now gate guardian at Čáslav airport
4008	MiG-21MF*	96004008	28-7-75	17-9-75	1. SLP	8. SLP, 82. SSLT, withdrawn 9-1993 and stored Plzeň-Líně, subsequently scrapped
4017 Black	MiG-21MF*	96004017	29-8-75	17-9-75	1. SLP	9. SLP, 9. SBoLP, 82. SSLT, from 9-1993 to 1999 at Plzeň-Líně Aircraft Repair Plant, became **MiG-21MFN** 1999-2000, grey overall. 41. SLT, 211. TL, withdrawn 1 to 5-2005 and stored Přerov, noted 2006
4038	MiG-21MF*	96004038	1-8-75	17-9-75	1. SLP	8. SLP, 82. SSLT, 9-1993 withdrawn 9 to 11-1993, stored Plzeň-Líně, sold to Canada where preserved at Comox Air Force Museum
4101	MiG-21MF*	96004101	1-8-75	17-9-75	1. SLP	8. SLP, 82. SSLT, withdrawn 9-1993 and stored Plzeň-Líně, later scrapped
4127	MiG-21MF*	96004127	1-8-75	17-9-75	1. SLP	8. SLP, 82. SSLT, damaged landing 6-1991, repaired in service, 4. SSLT, 42. SLT, 41. SLT, became **MiG-21MFN** 1999-2000, crashed 10-10-2000
4175 Black	MiG-21MF*	96004175	29-8-75	17-9-75	1. SLP	9. SLP, 9. SBoLP, 82. SSLT, 4. SSLT, 42. SLT, 41. SLT, silver overall; became **MiG-21MFN** 1999-2000, grey overall, 211. TL, withdrawn 12-7-2005 and stored Přerov, noted 2006
4306	MiG-21MF	964306	17-7-71	8-1971	4. SLP	9. SLP, damaged Bechyně 10-5-1985 and written off
4307 Black (1)	MiG-21MF	964307	17-7-71?	8-1971	4. SLP	9. SLP, serial duplicated from 29-8-1975 until 3-12-1985 (see MiG-21MF '9307'), 5. SLP, 11. SLP, 28. SBoLP, 'Stress Team', stored 1994-9 at LZO Líně, then LZO České Budějovice, 4. ZTL Čáslav, silver overall. Decommissioned 1999, dismantled, front fuselage with cockpit exhibited at České Budějovice and rear fuselage and wings preserved at Zruč Air Park
4308	MiG-21MF	964308	19-7-71	30-7-71	4. SLP	9. SLP, 9. SBoLP, moved to 81. SSLT Sliač 22-10-1992, joined the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4309	MiG-21MF	964309	23-6-71	8-1971	4. SLP	**ECM**, 9. SLP, 9. SBoLP, 81. SSLT, allocated to Slovakia and flown to Malacký-Kuchyňa 30-10-1992 to join the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4310	MiG-21MF	964310	4-7-71	8-1971	4. SLP	**ECM**, 9. SLP, 9. SBoLP, 81. SSLT, allocated to Slovakia and flown to Malacký-Kuchyňa 6-11-1992 to join the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4311	MiG-21MF	964311	25-5-71	8-1971	4. SLP	**ECM**, 9. SLP, 9. SBoLP, 81. SSLT, allocated to Slovakia and flown to Sliač 22-10-1992 to join the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4312	MiG-21MF	964312	24-6-71	30-7-71	4. SLP	**ECM**, 9. SLP, 9. SBoLP, 81. SSLT, allocated to Slovakia and flown to Malacký-Kuchyňa 6-11-1992 to join the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4313	MiG-21MF	964313	24-6-71	8-1971	4. SLP	9. SLP, 9. SBoLP, 81. SSLT, allocated to Slovakia and flown to Sliač 22-10-1992 to join the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4314	MiG-21MF	964314	7-1971	8-1971	4. SLP	9. SLP, crashed 15-10-1975
4315	MiG-21MF	964315	7-1971	8-1971	4. SLP	9. SLP, 4. SLP, 9. SLP, 5. SLP, 11. SLP, crashed 10-6-1992
4401	MiG-21MF	964401	24-6-71	8-1971	4. SLP	**ECM**, 9. SLP, 4. SLP, 9. SLP, 9. SBoLP; allocated to Slovakia and flown to Sliač 22-10-1992 for 81. SSLT and joined the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4402	MiG-21MF	964402	24-6-71	8-1971	4. SLP	**ECM**, 9. SLP, 4. SLP, 9. SLP, 9. SBoLP; allocated to Slovakia and flown to Sliač 23-10-1992 for 81. SSLT and joined the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006

4405 Black	MiG-21MF*	96004405	1-8-75	17-9-75	1. SLP	8. SLP, 82. SSLT, then 9-1993 to 2000 at and stored at Plzeň-Líně Aircraft Maintenance Base, where rebuilt as **MiG-21MFN** 1999-2000, painted grey overall as '4405 Grey'. 41. SLT?, 211. TL, withdrawn 12-7-2005, now preserved VM VHÚ
4421	MiG-21MF*	96004421	1-8-75	17-9-75	1. SLP	8. SLP, 82. SSLT, damaged Plzeň-Líně 9-1993 in collision with MiG-21MF '7701', withdrawn 12-7-2005 and stored Plzeň-Líně, reported scrapped
5209 Black	MiG-21MF	965209	2-3-72	4-3-72	4. SLP	**ECM**, 5. SLP, 11. SLP, 82. SSLT, 'Stress Team', 4. SSLT, 30-3-1994 at LZO Čáslav, moved to 43. SLT 1-1995, 43. SLT, silver overall, carried black panther's head emblem on port side of nose. Crashed 17-6-1999 after collision with MiG-21UM '9342'
5210	MiG-21MF	965210	3-2-72	3-1972	4. SLP	**ECM**, 5. SLP, 11. SLP, 82. SSLT, 28. SBoLP, 43. SLT, 41. SLT, 1-10-2001 withdrawn from use and stored České Budějovice, noted 2005 stored in Čáslav as a spares source, noted 2007 for sale at a storage yard in Přelouč
5211	MiG-21MF	965211		3-1972	4. SLP	5. SLP. Crashed 16-8-1972 or 28-8-1972, sources differ
5212 Black	MiG-21MF	965212	4-2-72	3-1972	4. SLP	5. SLP, 9. SLP, 5. SLP, 11. SLP, 40th anniversary colours with silver fuselage, blue/red spine and white tail with red digits '11'; 28. SBoLP, 43. SLT, 41 SLT. Withdrawn 2002, stored Čáslav, noted 7-2002 engineless, still preserved there 2007 in 11. SLP anniversary colours
5213	MiG-21MF	965213	5-2-72	3-1972	4. SLP	**ECM**, 5. SLP, 11. SLP, 28. SBoLP, 43. SLT, 41. SLT?, probably withdrawn 1999 or 2000, stored České Budějovice, noted there 2005
5214	MiG-21MF	965214	10-2-72	3-1972	4. SLP	5. SLP, 11. SLP, 28. SBoLP, 43. SLT, 41. SLT?, noted 1998 České Budějovice, probably withdrawn 1999 or 2000 noted 2007 preserved Čáslav
5215	MiG-21MF	965215	16-2-72	3-1972	4. SLP	5. SLP, 11. SLP, 28. SBoLP, 43. SLT, damaged in accident Čáslav 2-9-1996, withdrawn and scrapped
5301	MiG-21MF	965301	19-2-72	3-1972	4. SLP	**ECM**, 5. SLP, 11. SLP, 28. SBoLP, 43. SLT, 41. SLT?, probably withdrawn 1999 or 2000, stored České Budějovice, noted there 2005, noted 2007 for sale at a storage yard in Přelouč
5302	MiG-21MF	965302	24-2-72	3-1972	4. SLP	5. SLP, 11. SLP, 28. SBoLP, 43. SLT, 41. SLT, withdrawn 26-4-2001, stored České Budějovice Aircraft Repair Plant, noted there 2005, noted 2007 for sale at a storage yard in Přelouč
5303 Black	MiG-21MF	965303	18-2-72	3-1972	4. SLP	5. SLP, 11. SLP, 28. SBoLP, 43. SLT?, 41. SLT?, silver overall, tail artwork from 'Asterix' cartoon, named *Lovec Trevu*. Probably withdrawn 1999 or 2000, stored České Budějovice, noted there 2005, noted 2007 for sale at a storage yard in Přelouč
5304	MiG-21MF	965304	24-2-72	3-1972	4. SLP	5. SLP, 11. SLP, 28. SBoLP, 43. SLT?, 41. SLT?, probably withdrawn 1999 or 2000, stored České Budějovice, noted there 2005, noted 2007 for sale at a storage yard in Přelouč
5305	MiG-21MF	965305	22-2-72	3-1972	4. SLP	E, 5. SLP, 11. SLP, 28. SBoLP, 43. SLT?, 41. SLT?, withdrawn 22-2-2002, stored České Budějovice Aircraft Repair Plant, noted there 2005, noted 2007 for sale at a storage yard in Přelouč
5494	MiG-21MF*	96005494	1-8-75	17-9-75	1. SLP	Damaged in accident 22-7-1980, written off and scrapped
5508	MiG-21MF*	96005508	1-8-75	17-9-75	1. SLP	Damaged on landing České Budějovice 9-1-1976 but repaired, 8. SLP, 82. SSLT, 4. SSLT, 42. SLT?, 41. SLT?, 211. TL?, withdrawn from service between 10-2004 and 5-2005, stored at Přerov, sold to Mali
5512 Black	MiG-21MF*	96005512	1-8-75	17-9-75	1. SLP	8. SLP, 82. SSLT, 4. SSLT, 42. SLT?, 41. SLT, 211. TL?, grey overall. Withdrawn from service between 12-7-2005, stored at Přerov, sold to Mali
5581 Black	MiG-21MF*	96005581	1-8-75	17-9-75	1. SLP	8. SLP, 82. SSLT, then 9-1993 to 2000 at and stored LOZ Líně where rebuilt as **MiG-21MFN** and sent to 41. SLT?, 211. TL?, grey overall. Withdrawn 2005 and stored Přerov where noted 2006
5603 Black	MiG-21MF*	96005603	1-9-75	17-9-75	1. SLP	8. SLP, 82. SSLT, 4, SSLT, 42. SLT; became **MiG-21MFN** 1999-2000, painted grey overall as '5603 Grey'. 41. SLT, 211. TL, withdrawn from service 2005 (?) and stored Přerov where noted 2006
5612 Black	MiG-21MF*	96005612	31-8-75	17-9-75	1. SLP	8. SLP, 82. SSLT, withdrawn from service, moved to Plzeň-Líně and stored between 9 and 11-1993, preserved 2004 Brno Technical Museum, grey overall
7611	MiG-21MF	967611	20-6-73	6 to 10-1973	6. SBoLP	5. SLP, 11. SLP, 9-1993 moved to Plzeň-Líně and stored but later believed scrapped
7701 Black	MiG-21MF	967701	22-6-73	6 to 10-1973	6. SBoLP	E, 9. SLP, 9. SBoLP, silver overall. Painted in 'Delta' aerobatic team colours in 1992 (black overall with white/red/blue arrows on upper surfaces and 'LS' on rudder), 11. SLP, 82. SSLT, damaged Plzeň-Líně 9-1993 in collision with MiG-21MF '4421' but repaired, 11-1993 moved to 4. SSLT, 'Stress Team' Čáslav; between 6 and 9-1994 stored at Plzeň-Líně, 21-7-1997 to LZO České Budějovice, painted in experimental three-tone disruptive grey scheme with low-visibility insignia as '7701 Grey'. Moved 1999 to 41. SLT, withdrawn from service 21-3-2002 and put into storage at LZO České Budějovice where noted 2005
7702	MiG-21MF	967702	13-6-73	6 to 10-1973	6. SBoLP	9. SLP, 9. SBoLP, to 81. SSLT Sliač 6-11-1992, allocated to Slovakia from 1-1-1993, stored Sliač where noted 2006

7703	MiG-21MF	967703	14-6-72	6 to 10-1973	6. SBoLP	9. SLP, 9. SBoLP, to 81. SSLT Sliač 6-11-1992, allocated to Slovakia from 1-1-1993, stored Sliač where noted 2006
7704	MiG-21MF	967704	11-6-72	6 to 10-1973	6. SBoLP	9. SLP, 9. SBoLP, to 81. SSLT Sliač 12-1992, allocated to Slovakia from 1-1-1993, stored Sliač where noted 2006
7705 Black	MiG-21MF	967705	22-6-73	6 to 10-1973	6. SBoLP	**ECM**, 81. SSLT, 9. SBoLP, 11. SLP, dark green/dark earth camouflage. Withdrawn from service 9-1993 and stored Plzeň-Líně, later preserved VM VHÚ store
7706	MiG-21MF	967706	15-6-73	6 to 10-1973	6. SBoLP	9. SLP, 9. SBoLP, to 81. SSLT Sliač 4-11-1992, allocated to Slovakia from 1-1-1993, stored Sliač where noted 2006
7707 Black	MiG-21MF	967707	15-6-73	6 to 10-1973	6. SBoLP	9. SLP, 9. SBoLP, to 81. SSLT Sliač 30-11-1992 or 22-10-1992, silver overall. Outfitted as a camera ship for moviemaking purposes with cine-cameras in the cockpit and in a special pod on the centreline. Allocated to Slovakia from 1-1-1993, stored Piešťany where noted 2006
7708	MiG-21MF	967708	16-6-73	6 to 10-1973	6. SBoLP	9. SLP, 9. SBoLP, to 81. SSLT Sliač 30-11-1992, allocated to Slovakia from 1-1-1993, stored Sliač until sold to Kelvin Petty, UK, who donated it as N7708 to SW Florida Defense Antiquities Museum
7709 Black	MiG-21MF	967709	6-1973	6 to 10-1973	6. SBoLP	5. SLP, 9. SLP, 9. SBoLP and 1992 painted in 'Delta' aerobatic team colours. Crashed 28-8-1992
7710	MiG-21MF	967710	18-6-73	9-7-73	6. SBoLP	5. SLP?, 9. SLP, 9. SBoLP; dark green/dark earth camouflage. Allocated to Slovakia from 1-1-1993, overhauled LOK then ferried 13-4-1993 to Malacký-Kuchyňa but noted stored Sliač 2006
7711	MiG-21MF	967711	21-6-73	25-7-73	6. SBoLP	**ECM**, 9. SLP, 9. SBoLP; dark green/dark earth camouflage. 1992 painted in 'Delta' aerobatic team colours over basic camouflage; 11. SLP, 82 SSLT, 4. SSLT, to LZO Čáslav 7-6-1994, damaged in accident at LZO České Budějovice 8-6-1998 and written off
7712	MiG-21MF	967712	18-6-73	6 to 10-1973	6. SBoLP	9. SLP, 9. SBoLP, allocated to Slovakia from 1-1-1993, noted stored Sliač 2006
7713	MiG-21MF	967713	28-6-73	6 (?) to 10-1973	6. SBoLP	Later received 'German-style' camouflage, 8. SLP, to 81. SSLT Sliač 1992, allocated to Slovakia from 1-1-1993, noted stored Sliač 2004
7714	MiG-21MF	967714	28-6-73	6 (?) to 10-1973	6. SBoLP	8. SLP, to 81. SSLT Sliač 1992, allocated to Slovakia from 1-1-1993, now preserved at Košice Museum
7715	MiG-21MF	967715	28-6-73	6 (?) to 10-1973	6. SBoLP	Moved to 81. SSLT Sliač 1992, allocated to Slovakia from 1-1-1993, noted stored Sliač 1998 but not noted since, possibly scrapped or sold
7801	MiG-21MF	967801	5-7-73	6 (?) to 10-1973	6. SBoLP	**ECM**, to 81. SSLT Sliač 5-1991, allocated to Slovakia from 1-1-1993, now preserved Košice Museum
7802	MiG-21MF	967802	30-6-73	7 to 10-1973	6. SBoLP	8. SLP, 11. SLP, 82. SSLT, 4. SSLT?, 43 SLT?, 41 SLT?, decommissioned 2002, noted withdrawn from use Čáslav engineless 7-2002, reported stored České Budějovice 2005, noted 2007 for sale at a storage yard in Přelouč
7803	MiG-21MF	967803	5-7-73	7 to 10-1973	6. SBoLP	**ECM**, moved to 81. SSLT Sliač 5-1991, allocated to Slovakia from 1-1-1993, 81. SSLT, stored Sliač, noted there 2006
7804	MiG-21MF	967804	6 to 7-1973	7 to 10-1973	6. SBoLP	Damaged 17-1-1979 and written off
8205	MiG-21MF*	96008205	15-9-73	10-1973	6. SBoLP	**ECM**, moved to 81. SSLT Sliač 5-1991, allocated to Slovakia from 1-1-1993, 81. SSLT, stored Sliač, later preserved stored at Košice Museum
8206	MiG-21MF*	96008206	22-9-73	10-1973	6. SBoLP	8. SLP, 11. SLP, withdrawn from service 9-1993 and stored Plzeň-Líně and later scrapped
8207 Black	MiG-21MF*	96008207	17-9-73	10-1973	6. SBoLP	**ECM**, 8. SLP, dark green/dark earth camouflage; had white stripe applied to tail for an exercise. Moved to 81. SSLT Sliač 5-1991, allocated to Slovakia from 1-1-1993, stored Sliač, noted there 2006
8208	MiG-21MF*	96008208	29-9-73	10-1973	6. SBoLP	Moved to 81. SSLT Sliač 5-1991, allocated to Slovakia from 1-1-1993, stored Sliač, noted there 2006
8209	MiG-21MF*	96008209	20-9-73	10-1973	6. SBoLP	Moved to 81. SSLT Sliač 5-1991, allocated to Slovakia from 1-1-1993, stored Sliač, later preserved Košice Museum
9307	MiG-21MF*	96004307	29-8-75	19-9-75 or 10-10-75	1. SLP as 4307 (2)	Painted as 4307 (see this serial) until 3-12-1985, when renumbered 9307 to avoid confusion on moving to 9. SLP, 9. SBoLP, 82. SSLT, withdrawn from use 9-1993 and stored Plzeň-Líně until sold to Oscar Vickery, Galveston, TX, USA as N9307 (registration documents show 96004307)
9404	MiG-21MF	969404	30-6-74	7 to 10-1974	6. SBoLP	Transferred to 81. SSLT Sliač, 5-1991, allocated to Slovakia from 1-1-1993, 81. SSLT, stored Sliač, later preserved Prešov Museum
9406	MiG-21MF	969406	25-6-74	7 to 10-1974	6. SBoLP	Transferred to 81. SSLT Sliač, 5-1991, allocated to Slovakia from 1-1-1993, 81. SSLT, stored Sliač, last noted there 1998
9409	MiG-21MF	969409	15-6-74	7 to 10-1974	6. SBoLP	**ECM**, 81. SSLT, 9. SBoLP, 11 SLP, decommissioned 9-1993 and stored at Plzeň-Líně, later scrapped but cockpit noted preserved at Zruč Air Park 2003

9410 Black	MiG-21MF	969410	12-6-74	26-7-74	6. SBoLP	1. LŠP, 28. SBoLP, dark green/dark earth camouflage; 'Stress Team' LZO from 3- to 12-1994, 43. SLT?, 41. SLT?, 211. LT?, decommissioned 3 to 4-2004 and ferried to České Budějovice where stored, noted 2005
9411	MiG-21MF	969411	13-6-74	7 to 10-1974	6. SBoLP	1. LŠP, decommissioned 9 to 11-1993, transferred to Plzeň-Líně and put into storage, some sources suggest České Budějovice, probably now scrapped
9412	MiG-21MF	969412	19-6-74	7-1974	6. SBoLP	1. LŠP, 28. SBoLP, 'Stress Team' LZO 22-3-1994 to ?-1994, decommissioned 9 to 11-1994 and stored Plzeň-Líně but later scrapped
9413	MiG-21MF	969413	25-6-74	7 to 10-1974	6. SBoLP	1. LŠP, 6-1993 exchanged wings with MiG-21MA '1207', damaged 28-7-1993 in forced landing with undercarriage not fully extended, repaired, 9 to 11-1994 decommissioned and stored Plzeň-Líně, some minor damage repaired in store, reported scrapped, nose going to Brno-Černovice
9414 Black	MiG-21MF	969414	20-6-74	22-7-1974	6. SBoLP	1. LŠP, 28. SBoLP, 'Stress Team' LZO from 22-3-1994 to 13-5-1994, 43. SLT?, 41. SLT?, 211. TL?; dark green/dark earth camouflage, twin yellow bands on tail. Decommissioned 4-2004 Čáslav, noted stored LOZ České Budějovice 2005
9415	MiG-21MF	969415	17-6-74	7 to 10-1974	6. SBoLP	1. LŠP, decommissioned 9 to 11-1993 and stored Plzeň-Líně, reported stored Přerov 1994, by now probably scrapped
9501	MiG-21MF	969501	30-6-74	7 to 10-1974	6. SBoLP	**ECM**, 81. SSLT Sliač, allocated to Slovakia from 1-1-1993, stored Sliač, last noted there preserved as gate guard 2005
9502	MiG-21MF	969502	30-6-74	7 to 10-1974	6. SBoLP	81. SSLT Sliač, allocated to Slovakia from 1-1-1993, stored Sliač, now preserved Košice Museum
9503	MiG-21MF	969503	7 to 8-1974?	7 to 10-1974	6. SBoLP	**ECM**, 5. SLP?, 1. LŠP? Damaged in accident 23-11-1989 and written off
9706	MiG-21MF	969706	8-1974	8 to 10-1974	6. SBoLP	5. SLP, 1. LŠP, crashed 1-10-1991, Algerian pilot killed
9707 Black	MiG-21MF	969707	28-8-74	8 to 10-1974	6. SBoLP	**ECM**, 5. SLP, 1. LŠP, 8. SLP, 11. SLP, 28. SBoLP, 42 SLT, from 1-1-1997 4. ZTL, dark green/dark earth camouflage. Decommissioned 1999-2000 (?), believed scrapped
9708	MiG-21MF	969708	26-8-74	8 to 10-1974	6. SBoLP	5. SLP, 1. LŠP, decommissioned 9 to 11-1993 and stored Plzeň-Líně, believed scrapped
9709	MiG-21MF	969709	26-8-74	8 to 10-1974	6. SBoLP	5. SLP, (9. SLP?) 1. LŠP, decommissioned 9 to 11-1993, believed scrapped
9710	MiG-21MF	969710	31-8-74	9 to 12-1974	4. SLP	8. SLP, 81. SSLT Sliač in 6-1989, allocated to Slovakia from 1-1-1993, 81. SSLT, stored Sliač, probably scrapped
9711 Black	MiG-21MF	969711	3-9-74	9 to 12-1974	4. SLP	8. SLP, 4. SSLT, 42. SLT, 41. SLT, 211. TL, silver overall. Decommissioned 3 to 4-2004 and moved to LOZ České Budějovice, noted there 2005
9712	MiG-21MF	969712	1-10-74	10 to 12-1974	4. SLP	9. SLP, 9. SBoLP, allocated to Slovakia from 1-1-1993, overhauled Malacký-Kuchyňa 13-4-1993, from 2005 stored Trenčín for Military Museum Piešťany
9713	MiG-21MF	969713	26-8-74	9 to 12-1974	4. SLP	9. SLP, 4. SLP, 9. SLP, 9. SBoLP, allocated to Slovakia and flown 22-10-1992 to Sliač, Slovak AF from 1-1-1993, stored Sliač, now stored Trenčín for Military Museum Piešťany
9714	MiG-21MF	969714	1-10-74	10 to 12-1974	4. SLP	**ECM**, 9. SLP, 5. SLP, 1. SLP, 8. SLP, 81. SSLT, 82. SSLT, decommissioned 9 to 11-1993 and stored at Plzeň-Líně, noted there 1998 but probably scrapped later
9715	MiG-21MF	969715	10-1974	10 to 12-1974	4. SLP	Crashed 3-3-1982
9801 Black	MiG-21MF	969801	4-10-74	10 to 12-1974	4. SLP	9. SLP, 9. SBoLP, 28. SBoLP, 11. SLP?, 42. SLT, 41. SLT, 211. TL, dark green/dark earth camouflage. Decommissioned 9-2004 after reaching maximum age limit of 30 years and stored České Budějovice, noted there 2005
9802 Black	MiG-21MF	969802	14-9-74	25-9-74	4. SLP	5. SLP, 1. LŠP, 4. SSLT, LZO at Plzeň-Líně from 1-1995 to 23-1-1997 when aircraft was damaged in landing accident and written off. Dark green/dark earth camouflage
9803	MiG-21MF	969803	10-1974	10 to 12-1974	4. SLP	5. SLP, damaged in a collision 4-5-1988 with 9902 and written off
9804	MiG-21MF	969804	20-9-74	9 to 12-1974	4. SLP	5. SLP, 1. LŠP, 4. SSLT, 42. SLT, 41. SLT?, 211. TL?; decommissioned 9-2004, but reported used for 10 flights patrolling the border, then stored České Budějovice, noted there 2005
9805	MiG-21MF	969805	22-9-74	11-1974	5. SLP	1. LŠP, 4. SSLT, 42. SLT, 41. SLT?, 211. TL?, decommissioned 9-2004 but reported used for 10 flights patrolling the border and stored České Budějovice, noted there 2005
9812	MiG-21MF	969812	9-1974	11-1974	5. SLP	Crashed 19-12-1985
9813	MiG-21MF	969813	20-9-74	11-1974	5. SLP	1. LŠP, allocated to Slovak AF from 1-1-1993, 81. SSLT, ferried to Sliač and stored there, noted 1998 but probably now scrapped
9814	MiG-21MF	969814	13-10-74	12-12-74	4. SLP	9. SLP, 4. SLP, 9. SLP, 9. SBoLP, ferried to Malacký-Kuchyňa 6-11-1992, allocated to Slovak AF from 1-1-1993, now preserved Prešov Museum
9815	MiG-21MF	969815	8-10-74	11 to 12-1974	4. SLP	6. SBoLP, 5. SLP, 1. LŠP, allocated to Slovak AF from 1-1-1993 and ferried Sliač for 81. SSLT, where stored, noted 1997 but probably now scrapped
9901	MiG-21MF	969901	10 to 12-1974	11-1974	5. SLP	Damaged in accident 21-4-1981 and written off
9902	MiG-21MF	969902	12-1974?	12-1974?	4. SLP	5. SLP, crashed 4-5-1988 after collision with MiG-21MF '9803'

Czechoslovak Air Force MiG-21U trainers

Serial	Version	C/n	Delivery date	First unit	Comments
0816 Black	MiG-21U (*izd.* 66-400)	660816	4-1965	1. LŠP	To Kbely 23-11-1981 for examination and conversion into testbed for VS-2 ejection seats; first post-conversion flight 30-9-1982, returned to service but with 4. SLP as OK-016; silver overall with photo calibration markings on fuselage and tail plus lightning bolt on nose. Overhauled by LOK 1988-89, received silver/red/white/blue special colours with VZLÚ tail titles and test ejection markers, VZS 031 at Kbely, noted at Žatec 24-5-1991, Plzeň-Líně 23-10-1991, reverted to military markings as 0816 but in same colours. Last flight 17-5-1997 to Kbely, decommissioned and stored VZLÚ, noted for sale 2004
0817 Black	MiG-21U (*izd.* 66-400)	660817	4-1965	1. LŠP	Decommissioned 20-3-1991 and placed into storage Vodochody, 12-10-1994, now preserved Vyškov Museum, silver overall with yellow band around rear fuselage to denote non-combatant status
1117 Black	MiG-21U (*izd.* 66-400)	661117	4-1965	9. SLP	1. LŠP, silver overall. Decommissioned 20-3-1991, then into storage Vodochody where scrapped 30-5-1994

Czechoslovak/Czech Air Force MiG-21Us (continued)

Serial	Version	C/n	Delivery date	First unit	Comments
2418	MiG-21U (*izd.* 66-600)	662418	3-1966	1. LŠP	Crashed 14-10-1988
2419	MiG-21U (*izd.* 66-600)	662419	5-1966	1. LŠP	Ferried to Vodochody for storage 20-3-1991, allocated to Slovak AF from 1-1-1993 and ferried Sliač 20-9-1993 and decommissioned then stored, later preserved and stored Trenčín for Military Museum Piešťany
2820	MiG-21U (*izd.* 66-600)	662820	5-1966	1. LŠP	Decommissioned Přerov 17-7-1990, currently stored VM VHÚ
2916	MiG-21U (*izd.* 66-600)	662916	5-1966	1. LŠP	Decommissioned 20-3-1991 and ferried to Vodochody, allocated to Slovak AF from 1-1-1993, engine changed 22-7-1993 at LOK and ferried Sliač 13-6-1994 where stored, now preserved and stored for Martin Museum
4820	MiG-21U (*izd.* 66-600)	664820	8-1967	4. SLP	Decommissioned 17-7-1990 at 1. LŠP Přerov, allocated to Slovak AF from 1-1-1993, now reported to be preserved at Burton Station, Ohio, USA where noted 2004
4916 Black	MiG-21U (*izd.* 66-600)	664916	7-1967	?	1. SLP in 1970, later 1. LŠP, silver overall with unit badge on nose and chequered fin cap. Ferried 12-4-1991 Vodochody, decommissioned and stored, 17-8-1994 preserved stored at VM VHÚ
4917	MiG-21U (*izd.* 66-600)	664917	6-1967	1. LŠP	Ferried to Vodochody 20-3-1991, stored and 16-8-1994 scrapped
4918	MiG-21U (*izd.* 66-600)	664918	9-1967	1. LŠP	Ferried to Vodochody 20-3-1991, stored and 16-8-1994 scrapped

Czechoslovak/Czech Air Force MiG-21USs

Serial	Version	C/n	Manufacture date	Delivery date	First unit	Comments
0133 Black	MiG-21US	01685133		11-1968	9. SLP	1. SLP, 8. SLP, silver overall. Decommissioned 18-3-1991 at Brno, transferred to VM VHÚ but currently preserved Zruč Air Park.
0241	MiG-21US	02685141		7-1969	11. SL	After decommissioning in 1993 operated by VZLÚ as OK-004 until 1997, then moved to VM VHÚ. Sold to France as F-ZAGR 6-2001 and preserved at Istres-les-Tube, then sold to Wanaka Transport & Toy Museum, New Zealand
0341	MiG-21US	03685141		7-1969	1. SLP	Crashed 26-5-1972
0441	MiG-21US	04685141		7-1969	47. PZLP	8. SLP; moved to 81. SSLT Sliač 5-1991, allocated to Slovak AF from 1-1-1993, stored Sliač, now preserved and stored Trenčín for Military Museum Piešťany
0541	MiG-21US	05685141	1-11-69	11-1969	47. PZLP	9. SLP, used for the film *Pod nohama nebe* (The Sky Under Our Feet), 47. PZLP, 28. SBoLP, decommissioned autumn 1993 and stored Plzeň-Líně but now reported scrapped
0641	MiG-21US	06685141		11-1969	11. SLP	Crashed 21-1-1983
0646	MiG-21US	06685146	7-4-70	5-1970	8. SLP	11. SLP, 81. SSLT, allocated to Slovak AF from 1-1-1993, stored Sliač, now preserved and stored Trenčín for Military Museum Piešťany
0732	MiG-21US	07685132	1-11-68	11-1968	47. PZLP	11. SLP, 47. PZLP, 28. SBoLP, decommissioned 9-1993 and stored Plzeň-Líně but now reported scrapped

0746	MiG-21US	07685146		5-1970	9. SLP	8. SLP, crashed 11-4-1989
0832	MiG-21US	08685132	1-11-68	11-1968	47. PZLP	11. SLP, 47. PZLP, 28. SBoLP, decommissioned 9-1993 and stored Plzeň-Líně until sold as N9242N, owned by Air USA Inc., Baker, MT, USA. Crashed into the sea 24-8-1999
0948 Black	MiG-21US	09685148	17-6-70	7-1970	9. SLP	1. SLP?, 11. SLP, 28. SBoLP, silver overall. 9-1993 stored Plzeň-Líně, decommissioned 1994 and currently stored VM VHÚ
1032	MiG-21US	10685132		11-1968	8. SLP	Crashed 12-7-1983
1048	MiG-21US	10685148	12-7-70	7-1970	1. SLP	11. SLP, 28. SBoLP, 9 to 11-1993 decommissioned and stored Plzeň-Líně, reported scrapped

Czechoslovak/Czech Air Force MiG-21UMs

Serial	Version	C/n	Manufacture date	Delivery date	First unit	Comments
0165 Black	MiG-21UM	01695165	12-4-72	16-6-72	4. SLP	5. SLP, 11. SLP, 82. SSLT, LZO Čáslav, silver overall. Decommissioned 7-1994 and stored Plzeň-Líně, sold as N1165 to MIGs of Delaware, Wilmington, DE, USA
0268	MiG-21UM	02695168	10-8-72	5-10-72	4. SLP	47. PZLP, 5. SLP, 9. SLP, 9. SBoLP, 6-11-1992 moved to Malacký-Kuchyňa, allocated to Slovak AF from 1-1-1993, now preserved Košice Museum
0368	MiG-21UM	03695168	15-8-72?	5-10-72	4. SLP	1. LŠP, 6-11-1992 moved to Malacký-Kuchyňa, allocated to Slovak AF from 1-1-1993, stored Sliač, noted there 2006
0468	MiG-21UM	04695168	20-8-72	8-1972	5. SLP	11. LSP, decommissioned 9 to 11-1993 and stored at Plzeň-Líně, sold as N7803S to Vulcan Warbirds Inc., Seattle, WA, USA
0475	MiG-21UM	04695175	29-5-73	6-1973?	6. SLP	8. SLP, to 81. SSLT, Sliač 5-1991, allocated to Slovak AF from 1-1-1993, 81. SSLT, stored Sliač, now preserved Košice Museum
1061	MiG-21UM	516921061		10-1974	9. SLP	Damaged 3-8-1979 in accident at Bechyně and written off
1071	MiG-21UM	516921071	20-10-74	10-1974	47. PZLP	11. SLP, 1. LŠP, decommissioned 1994 and stored Plzeň-Líně, later sold as N21EV to Elaine Vickery, Galveston, TX, USA
3036	MiG-21UM	516913036	20-2-74	1974	1. LŠP	Decommissioned 5-1994 and stored Plzeň-Líně, later sold in USA as N7238T to MIG-21 Corp, Atwater, CA, USA
3041	MiG-21UM	516913041	22-2-74	3 to 4-1974	9. SLP	1. LŠP, 47. PZLP, 1. LŠP, 19-11-1992 moved to Malacký-Kuchyňa, allocated to Slovak AF from 1-1-1993, now preserved and stored Trenčín for Military Museum Piešťany
3046 Black	MiG-21UM	516913046	3-1-74	3-1974	4. SLP	8. SLP, 82. SSLT, 4. SSLT, silver overall. Decommissioned 1994 and stored at Plzeň-Líně until sold as N21UT to Experimental Rocket Racing Association, Bothell, WA, USA
3051	MiG-21UM	516913051	28-2-74	22-4-74	9. SLP	Moved to Malacký, allocated to Slovak AF from 1-1-1993, decommissioned 1994 and stored at Plzeň-Líně until sold as N21UT to Experimental Rocket Racing Association, Bothell, WA, USA
3156	MiG-21UM	516931056	28-2-75	5-4-75	4. SLP	5. SLP, 4. SLP, 1. LŠP, 19-11-1992 moved to Malacký-Kuchyňa, allocated to Slovak AF from 1-1-1993, now preserved and stored Trenčín for Military Museum Piešťany
3166	MiG-21UM	516931066	1-4-75	4-1975	82. SSLT?	11. SLP, decommissioned 9 to 11-1993 and stored Plzeň-Líně, later preserved VM VHÚ store
3171	MiG-21UM	516931071	16-2-75	4-1975	5. SLP	1. SLP, 5. SLP, 11. SLP 5-1991 where given sharkmouth and eyes, later painted out. 9-1993 to 28. SBoLP; decommissioned 7-1994 or 9-11-1993 and stored at Plzeň-Líně; later sold as N20739 to MIGS of Delaware, Wilmington, DE, USA
3176	MiG-21UM	516931076	18-2-75	30-4-75	9. SLP	9. SBoLP, 6-11-1992 moved to Malacký-Kuchyňa, allocated to Slovak AF from 1-1-1993, stored Sliač, still there 2001
3181 Black	MiG-21UM	516931081	22-2-75	4-1975	6. SBoLP	9. SLP, 9. SBoLP, 11. SLP, 28. SBoLP, silver overall. Decommissioned 5-1994 and stored Plzeň-Líně, now preserved at VM VHÚ
3186 Black	MiG-21UM	516931086	1-4-75	4-1975	1. LŠP	Noted 1994 at 4. ZSL, 43. SLT, end of 1998 seen at 4. NTL, silver overall. Decommissioned 1999, noted stored České Budějovice 2005, noted 2007 for sale at a storage yard in Přelouč
3741	MiG-21UM	516937041	4-5-75	7-1975	1. SLP	1. LŠP, 81. SSLT Sliač 1982 onwards, allocated to Slovak AF from 1-1-1993, stored Sliač, still there 2001
3746	MiG-21UM	516937046	15-5-75	7-1975	1. SLP	1. LŠP, 42. SSLT, believed decommissioned 1998-99; noted stored České Budějovice 2005, noted 2007 for sale at a storage yard in Přelouč
3751	MiG-21UM	516937051	6-5-75	7-1975	1. SLP	9. SLP, 5. SLP, 1. LŠP, decommissioned 9 to 11-1993 and stored at Plzeň-Líně until sold as N3751L to private owner in Portland, OR, USA
3756 Black	MiG-21UM	516937056	6-5-75	7-1975	1. LŠP	To LZO Čáslav 3-1994, silver overall with 'camel and Giza pyramids' nose art. In 1995 given grey/blue/'wooden' paint job with 'crazy quasi-sharkmouth' as '3756 Yellow' for the 'Stress Team', 3-1994 until 6-1998 at LZO Čáslav. Damaged 8-6-1998 in collision with MiG-21MF '7711' over České Budějovice, crew ejected and aircraft crashed

5026	MiG-21UM	516905026	17-9-73?	10-1973	4. SLP	6. SBoLP, 4. SLP, 9. SLP, although allocated to Slovak AF from 1-1-1993 underwent overhaul at LOK until 26-8-1993 when ferried to Slovakia, now preserved and stored Trenčín for Military Museum Piešťany
5031	MiG-21UM	516905031	31-8-73	9-1973	6. SBoLP	1. LŠP, 6. SBoLP, 1. LŠP, 6. SBoLP, 1. LŠP, 4. SSLT, 42. SSLT, 41. SSLT, decommissioned 1999-2000, noted 2002 stored at České Budějovice, noted 2007 for sale at a storage yard in Přelouč
5101	MiG-21UM	516923001	30-8-74	10-1974	6. SBoLP	81. SSLT Sliač, allocated to Slovak AF from 1-1-1993, 81. SSLT, stored Sliač, still there 2006
5166	MiG-21UM	516921066	28-8-74	10-1974	6. SBoLP	81, SSLT, 11. SLP, 81. SSLT Sliač, allocated to Slovak AF from 1-1-1993, 81. SSLT, stored Sliač, now preserved and stored Trenčín for Military Museum Piešťany
9011	MiG-21UM	516909011	1-12-73	1-1974	5. SLP	11. SLP, 42. SLT; 41. SLT? Decommissioned 1999-2000, noted 2005 stored stored at České Budějovice
9016	MiG-21UM	516909016		1974	9. SLP	Crashed 14-9-1978
9332 Black	MiG-21UM	516999332	26-9-80	10 to 11-1980	1. LŠP	43. SLT; 41. SLT?, 211. TL?, lately '9332 Grey' in NATO-style two-tone grey camouflage with low-visibility insignia. Decommissioned 12-5-2005, flown to VM VHÚ for preservation
9333 Black	MiG-21UM	516999333	15-10-80	10 to 11-1980	1. LŠP	43. SLT; 41. SLT?, 211. TL?, grey overall, silver nose. Noted 4-2003 as grounded, formally decommissioned 2 to 4-2004 and noted 2005 stored at České Budějovice
9341 Black	MiG-21UM	516999341	12-2-80	4-1980	1. LŠP	43. SLT; 41. SLT?, 211. TL, grey overall, silver nose, unit badge and web address (!) on rudder. Decommissioned 13-7-2005, ferried to Přerov and stored, reported sold to Mali
9342	MiG-21UM	516999342	20-2-80	4-1980	1. LŠP	42. SLT; 41. SLT?, crashed 17-6-1999 (?) after colliding with MiG-21MF 5209
9399	MiG-21UM	516999399	16-3-82	20-3-1982	1. LŠP	43. SLT; 41. SLT? Decommissioned 1999-2000 and noted 2005 stored České Budějovice

The MiG-21US (*izdeliye* 68A) was the next trainer variant and the first to be fitted with blown flaps. As with later versions of the MiG-21U-600, all had periscopes on the canopy giving the instructor in the rear seat a better view forward. Unlike both versions of the MiG-21U, which was also built at MMZ No. 30 'Znamya Truda' in Moscow, all MiG-21USs were produced by *zavod* 31 in Tbilisi. 13 were delivered between November 1968 and July 1970 and when new four were sent to 47. PZLP at Pardubice, three to 8. SLP at Brno, and two each to 1. SLP at České Budějovice, 9. SLP at Bechyně and 11. SLP at Žatec.

The MiG-21UM (*izdeliye* 69) was the last trainer variant and could be distinguished from previous models by the angle of attack indicator on the port side of the nose and the dorsal aerial in front of the tailfin. A total of 32 were delivered, the first arriving on 16th June 1972 and the last on 20th March 1982. Eight went when new to 1. LŠP at Přerov, six to 4. SLP at Pardubice, five each to 6. SBoLP at Přerov and 9. SLP at Bechyně, three each to 1. SLP at České Budějovice and 5. SLP at Plzeň-Líně, and one each to 47. SBoLP at Pardubice and 82. SSLT at Mošnov.

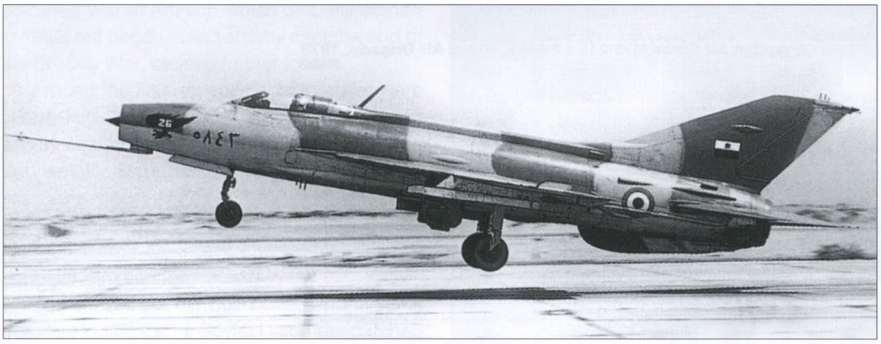
Egypt

On 2nd November 1930 King Fouad I decreed the formation of an Egyptian Army Air Force which, in 1937, became the autonomous Royal Egyptian Air Force. After the declaration of the Arab Republic on 18th June 1953 the **Arab Republic of Egypt Air Force** (EAF, or *al Quwwat al-Jawwiya il-Misriya*) was created. On 22nd February 1958 Syria and Egypt formed a union called the United Arab Republic; this was joined the same year by the Kingdom of Yemen to create the Union of Arab States. However, Syria seceded in 1961 while Egypt continued with the name until 1971. Between 1959 and 1971 the Egyptian Air Force was known as the **United Arab Republic Air Force** (UARAF) but then returned to being the Arab Republic of Egypt Air Force. In this section it will be referred to as the EAF to avoid possible confusion.

The first MiG-21F-13 (*izdeliye* 74) fighters arrived in June and July 1962 and equipped one Fighter Brigade, equivalent to a US Fighter Wing, comprising three squadrons. Another 80 were ordered in 1963 and followed in 1964 by 40 MiG-21U (*izdeliye* 66) trainers and 40 MiG-21PF (*izdeliye* 76) interceptors. The latter were sent to the Brigade that received the first supply of MiG-21F-13s, which were passed on to replace MiG-17s and MiG-19s in other regiments. In 1965 there was a reorganisation of the EAF; the brigades and squadrons were renumbered and by the outbreak of the Six-Day War on 6th June 1967, the EAF had received 235 MiG-21 fighters and 40 trainers. In fact, according to Israeli sources, losses in training and transfers to other Arab Air Forces had reduced the number to an estimated 102. Arab sources suggest 108 so the agreement is remarkably good. During this war the EAF lost, according to most well informed sources, nearly 100 MiG-21 fighters of which about 70 were destroyed while on the ground.

It is believed that 120 MiG-21F-13s were delivered and equipped squadrons in the 5th, 7th and 9th Air Brigades (AB): the AB numbers

All photos via RART



◀
MiG-21F-13 5843 of the Egyptian Air Force's 26th Fighter Sqn takes off.

Another view of the same aircraft. The transparency aft of the cockpit reveals this is a Soviet-built example.
▼

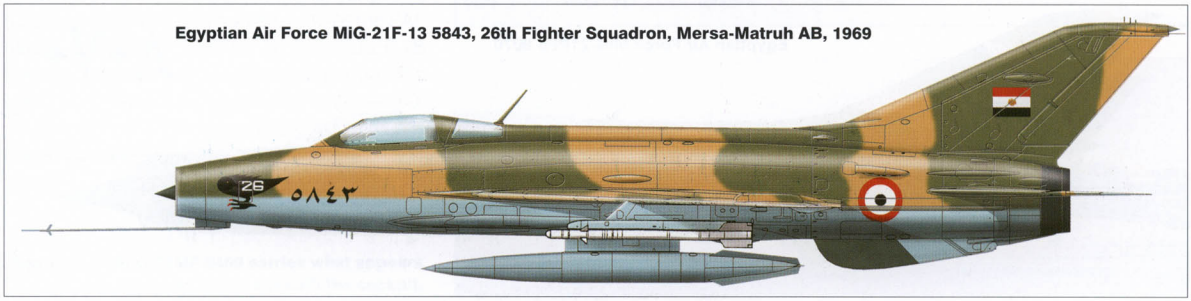
are those in use before the 1965 renumbering. Most of these MiG-21F-13s were destroyed in the Six-Day War.

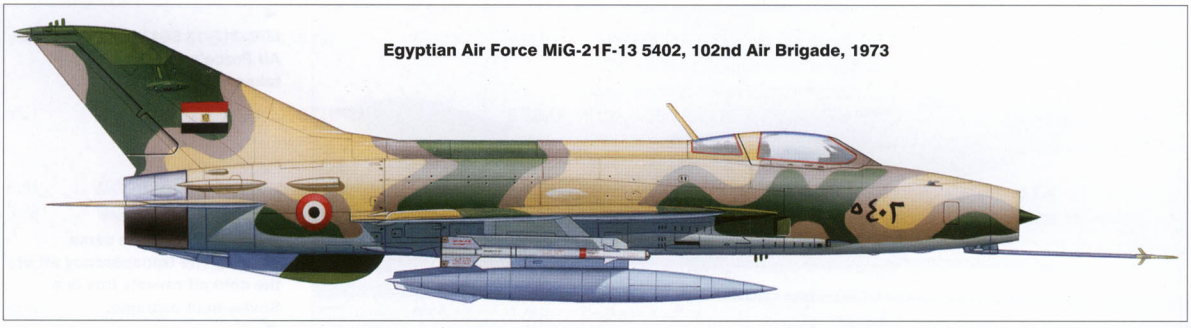
Reported EAF MiG-21F-13s are listed on page 529. The black serial numbers were in Arabic script.

After the devastating losses suffered in the Six-Day War, the Warsaw Pact countries made an effort to replenish the stock of MiG-21s as soon as possible and to this aim Czechoslovakia

◀
Another EAF MiG-21F-13, 5402, wearing a rather different camouflage scheme.

Egyptian Air Force MiG-21F-13 5843, 26th Fighter Squadron, Mersa-Matruh AB, 1969





Egyptian Air Force MiG-21F-13 5402, 102nd Air Brigade, 1973

sent 26 new MiG-21F-13s built by Aero-Vodochody under licence (formerly called S-106). It is believed that they were given serials 5701-5726 but in the table below it is assumed the EAF numbered them in the same numerical order as the CzAF.

The 40 MiG-21PFs (*izdeliye* 76 Version A) delivered in 1964 were numbered 5401-5440; almost all of them were destroyed by the end of 1967 either in accidents or the Six-Day War and replaced shortly afterwards by more modern types.

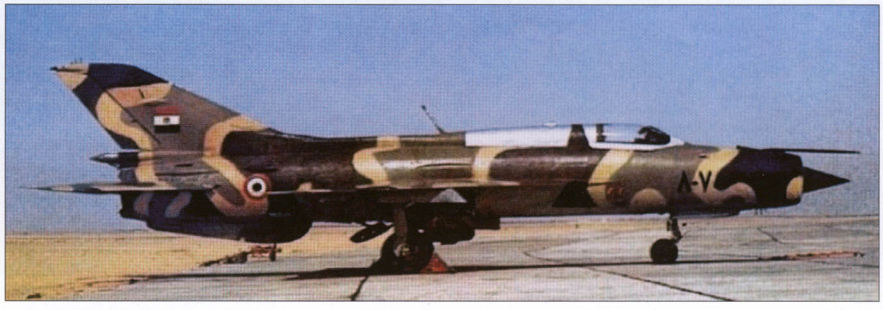
Arriving in 1966, the 75 MiG-21PFM (*izdeliye* 94A) were given serial numbers 5201-5275 and equipped four squadrons. Again, most of these aircraft had been destroyed by the end of the Six-Day War, after which no more than ten of the total of 235 MiG-21 fighters delivered were still extant.

Further deliveries took place after the Six-Day War and the reported serials are listed on page 530. Unfortunately there is no guarantee that the MiG-21PFMs were correctly identified.

The USSR and its allies made strenuous efforts to resupply the EAF and an undeclared number, reported to be 75, of MiG-21PFS (*izdeliye* 94A) fighters were delivered around 1970, receiving the serials 8001-8075. They were an intermediate step between the MiG-21PF and MiG-21PFM. All had the parabrake located under the rudder, blown flaps and forward-hinged one-piece canopy but no gun armament.

At least six MiG-21RF reconnaissance aircraft were supplied and equipped 64 Squadron.

The Six-Day War left the EAF not only very short of aircraft but also desperately deficient in pilots trained to fly MiG-21s. The air battles of the



via RART

▶ **Gaudily camouflaged Egyptian MiG-21PFS 8070. Oddly, the canopy frame and the saddle tank are not painted.**

Egyptian Air Force MiG-21PFS 8070

so-called War of Attrition which officially started in 1969, but began in fact shortly after the end of the Six-Day War, caused further losses.

Among the first replacements to arrive were twelve MiG-21Ms (*izdeliye* 96), a downgraded export version of the MiG-21SM. They received the serials 8301 to 8312; some reputable sources suggest these aircraft were MiG-21MFs (*izdeliye* 96F). These fighters would be particularly welcome as they carried a built-in twin barrel 23-mm cannon.

To help protect Egyptian cities and airfields from Israeli strikes the Soviet Union despatched five (some reputable sources state two) PVO regiments in early 1970 with MiG-21MF (*izdeliye* 96F) fighters and a large number of S-125 (SA-3) surface-to-air missile brigades. One regiment was the 135th IAP PVO, which was based on several airfields to protect the area south of Cairo and others, whose designation has not been discovered, were located around the Nile delta. Their aircraft wore EAF markings for appearance's sake, and when the Soviets left in July 1972, the surviving 94 (?) fighters remained in Egypt. More MiG-21MFs were delivered to the EAF itself, starting in 1970 or 1971, and 110 were reported to have arrived over the next few years, some after July 1972.

In 1964 forty MiG-21U (*izdeliye* 66) trainers were acquired but their exact version (*izdeliye* 66-400 or 66-600) is not known. They carried the serials 5601-5640.

Other deliveries followed, including around 1970, a substantial number, believed to be 24, of MiG-21US (*izdeliye* 68A) trainers, which were serialled 5641-5624. Some sources suggest some aircraft within this batch were MiG-21UMs (*izdeliye* 69A). There were subsequent deliveries of MiG-21UM. Two examples of the latter that have been photographed carried unusual serials (0642 and 4640); in the latter case the serial was apparently reused.

After Egypt turned to the Western Powers for the supply of aircraft, the American fighters were found to be a bit too expensive, and after trading in some MiG-23MFs for 40 Shenyang F-6 (Chinese-built MiG-19S) fighters in 1976 the EAF placed an order in 1980 for 80 Chengdu F-7B fighters. These licence-built developments of the MiG-21F-13 received serial numbers 4501-4580:

The 2007 EAF Order of Battle contains the following units flying MiG-21 variants:

Known Egyptian Air Force MiG-21F-13s (Soviet-built)

Serial	Version	Delivered	First unit	Comments
5001	MiG-21F-13	6-1962		
5006	MiG-21F-13			
5172	MiG-21F-13			Noted with this serial in 1965
5402	MiG-21F-13			Three-tone camouflage. Noted in 1973
5403	MiG-21F-13		102 AB	Noted with this serial in 1973
5843 Black	MiG-21F-13	1963-4	26 Sqn	Tan/green camouflage, unit badge on nose
5844	MiG-21F-13	1963-4		
5846	MiG-21F-13	1963-4		
5903	MiG-21F-13	1963-4		
5908 Black	MiG-21F-13	1963-4		Preserved Cairo Military Museum, Saladin Citadel; now without serial

Known Egyptian Air Force MiG-21F-13s (Czech-built/Avia S-106)

Serial	Version	C/n	Date Transferred	Comments
5701	MiG-21F-13	860801	14-4-1969	Ex CzAF 0801
5702	MiG-21F-13	860802	14-4-1969	Ex CzAF 0802
5703	MiG-21F-13	860803	14-4-1969	Ex CzAF 0803
5704	MiG-21F-13	860804	14-4-1969	Ex CzAF 0804
5705	MiG-21F-13	860805	14-4-1969	Ex CzAF 0805
5706	MiG-21F-13	860806	3-6-1969	Ex CzAF 0806
5707	MiG-21F-13	860807	3-6-1969	Ex CzAF 0807
5708	MiG-21F-13	860808	3-6-1969	Ex CzAF 0808
5709	MiG-21F-13	860809	3-6-1969	Ex CzAF 0809
5710	MiG-21F-13	860810	3-6-1969	Ex CzAF 0810
5711	MiG-21F-13	860811	3-6-1969	Ex CzAF 0811
5712	MiG-21F-13	860812	3-6-1969	Ex CzAF 0812
5713	MiG-21F-13	860813	3-6-1969	Ex CzAF 0813
5714	MiG-21F-13	860814	3-6-1969	Ex CzAF 0814
5715	MiG-21F-13	860815	3-6-1969	Ex CzAF 0815
5716	MiG-21F-13	960901	31-7-1969	Ex CzAF 0901
5717	MiG-21F-13	960902	4-12-1969	Ex CzAF 0902
5718	MiG-21F-13	960907	4-12-1969	Ex CzAF 0907
5719	MiG-21F-13	960908	4-12-1969	Ex CzAF 0908
5720	MiG-21F-13	960909	4-12-1969	Ex CzAF 0909
5721	MiG-21F-13	960910	4-12-1969	Ex CzAF 0910
5722	MiG-21F-13	960911	4-12-1969	Ex CzAF 0911
5723	MiG-21F-13	960912	4-12-1969	Ex CzAF 0912
5724	MiG-21F-13	960913	4-12-1969	Ex CzAF 0913
5755	MiG-21F-13	960914	4-12-1969	Ex CzAF 0914
5726	MiG-21F-13	960915	4-12-1969	Ex CzAF 0915

via RART

Egyptian AF MiG-21MF 8460 carries what appears to be a squadron badge beneath the cockpit.

Known Egyptian Air Force MiG-21PFs

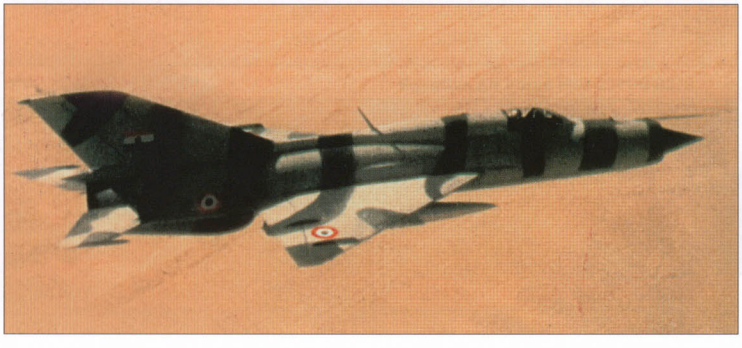
Serial	Version	Delivery date
5401	MiG-21PF	1964
5402	MiG-21PF	1964
5403	MiG-21PF	1964
5404	MiG-21PF	1964
5405	MiG-21PF	1964
5406	MiG-21PF	1964
5407	MiG-21PF	1964
5408	MiG-21PF	1964
5409	MiG-21PF	1964
5410	MiG-21PF	1964
5411	MiG-21PF	1964
5412	MiG-21PF	1964
5413	MiG-21PF	1964
5414	MiG-21PF	1964
5415	MiG-21PF	1964
5416	MiG-21PF	1964
5417	MiG-21PF	1964
5418	MiG-21PF	1964
5419	MiG-21PF	1964
5420	MiG-21PF	1964
5421	MiG-21PF	1964
5422	MiG-21PF	1964
5423	MiG-21PF	1964
5424	MiG-21PF	1964
5425	MiG-21PF	1964
5426	MiG-21PF	1964
5427	MiG-21PF	1964
5428	MiG-21PF	1964
5429	MiG-21PF	1964
5430	MiG-21PF	1964
5431	MiG-21PF	1964
5432	MiG-21PF	1964
5433	MiG-21PF	1964
5434	MiG-21PF	1964
5435	MiG-21PF	1964
5436	MiG-21PF	1964
5437	MiG-21PF	1964
5438	MiG-21PF	1964
5439	MiG-21PF	1964
5440	MiG-21PF	1964

►►▲ **5642, an Egyptian Air Force MiG-21US.**

► **The nose art carried by MiG-21US 5642.**

►► **MiG-21UM 5658 in an unusual high-visibility colour scheme. The orange markings are reminiscent of those worn by Israeli Dassault Mirage IIICJs.**

An Egyptian MiG-21PFM over the Sinai Desert. ▼



via RART

Known EAF MiG-21PFMs (pre Six-Day War)

Serial	Version	Delivery date
5201	MiG-21PFM (*izd.* 94A)	1966
5202	MiG-21PFM (*izd.* 94A)	1966
5203	MiG-21PFM (*izd.* 94A)	1966
5204	MiG-21PFM (*izd.* 94A)	1966
5205	MiG-21PFM (*izd.* 94A)	1966
5206	MiG-21PFM (*izd.* 94A)	1966
5207	MiG-21PFM (*izd.* 94A)	1966
5208	MiG-21PFM (*izd.* 94A)	1966
5209	MiG-21PFM (*izd.* 94A)	1966
5210	MiG-21PFM (*izd.* 94A)	1966
5211	MiG-21PFM (*izd.* 94A)	1966
5212	MiG-21PFM (*izd.* 94A)	1966
5213	MiG-21PFM (*izd.* 94A)	1966
5214	MiG-21PFM (*izd.* 94A)	1966
5215	MiG-21PFM (*izd.* 94A)	1966
5216	MiG-21PFM (*izd.* 94A)	1966
5217	MiG-21PFM (*izd.* 94A)	1966
5218	MiG-21PFM (*izd.* 94A)	1966
5219	MiG-21PFM (*izd.* 94A)	1966
5220	MiG-21PFM (*izd.* 94A)	1966
5221	MiG-21PFM (*izd.* 94A)	1966
5222	MiG-21PFM (*izd.* 94A)	1966
5223	MiG-21PFM (*izd.* 94A)	1966
5224	MiG-21PFM (*izd.* 94A)	1966
5225	MiG-21PFM (*izd.* 94A)	1966
5226	MiG-21PFM (*izd.* 94A)	1966
5227	MiG-21PFM (*izd.* 94A)	1966
5228	MiG-21PFM (*izd.* 94A)	1966
5229	MiG-21PFM (*izd.* 94A)	1966
5230	MiG-21PFM (*izd.* 94A)	1966
5231	MiG-21PFM (*izd.* 94A)	1966
5232	MiG-21PFM (*izd.* 94A)	1966
5233	MiG-21PFM (*izd.* 94A)	1966
5234	MiG-21PFM (*izd.* 94A)	1966
5235	MiG-21PFM (*izd.* 94A)	1966
5236	MiG-21PFM (*izd.* 94A)	1966
5237	MiG-21PFM (*izd.* 94A)	1966
5238	MiG-21PFM (*izd.* 94A)	1966
5239	MiG-21PFM (*izd.* 94A)	1966
5240	MiG-21PFM (*izd.* 94A)	1966
5241	MiG-21PFM (*izd.* 94A)	1966
5242	MiG-21PFM (*izd.* 94A)	1966
5243	MiG-21PFM (*izd.* 94A)	1966
5244	MiG-21PFM (*izd.* 94A)	1966
5245	MiG-21PFM (*izd.* 94A)	1966
5246	MiG-21PFM (*izd.* 94A)	1966
5247	MiG-21PFM (*izd.* 94A)	1966
5248	MiG-21PFM (*izd.* 94A)	1966
5249	MiG-21PFM (*izd.* 94A)	1966
5250 *	MiG-21PFM (*izd.* 94A)	1966
5251	MiG-21PFM (*izd.* 94A)	1966
5252	MiG-21PFM (*izd.* 94A)	1966
5253	MiG-21PFM (*izd.* 94A)	1966

5254	MiG-21PFM (*izd.* 94A)	1966
5255	MiG-21PFM (*izd.* 94A)	1966
5256	MiG-21PFM (*izd.* 94A)	1966
5257	MiG-21PFM (*izd.* 94A)	1966
5258	MiG-21PFM (*izd.* 94A)	1966
5259	MiG-21PFM (*izd.* 94A)	1966
5260	MiG-21PFM (*izd.* 94A)	1966
5261	MiG-21PFM (*izd.* 94A)	1966
5262	MiG-21PFM (*izd.* 94A)	1966
5263	MiG-21PFM (*izd.* 94A)	1966
5264	MiG-21PFM (*izd.* 94A)	1966
5265	MiG-21PFM (*izd.* 94A)	1966
5266	MiG-21PFM (*izd.* 94A)	1966
5267	MiG-21PFM (*izd.* 94A)	1966
5268	MiG-21PFM (*izd.* 94A)	1966
5269	MiG-21PFM (*izd.* 94A)	1966
5270	MiG-21PFM (*izd.* 94A)	1966
5271	MiG-21PFM (*izd.* 94A)	1966
5272	MiG-21PFM (*izd.* 94A)	1966
5273	MiG-21PFM (*izd.* 94A)	1966
5274	MiG-21PFM (*izd.* 94A)	1966
5275	MiG-21PFM (*izd.* 94A)	1966

*Sent to USA for testing in the early 1980s

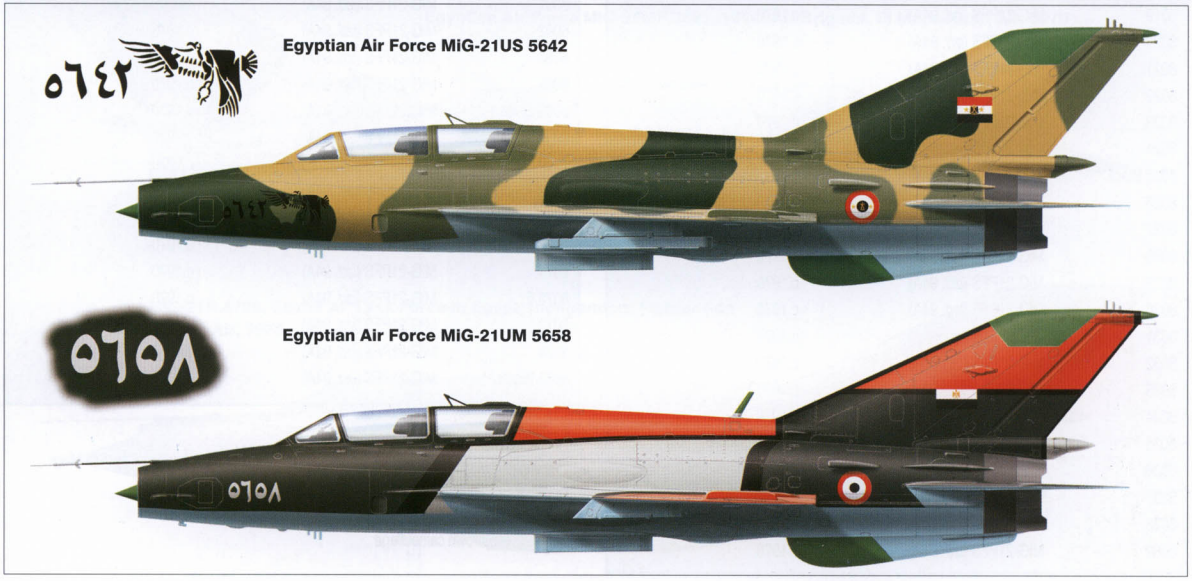
Known Egyptian Air Force MiG-21PFMs (post Six-Day War)

Serial	Version	Delivery date	Comments
1072	MiG-21PFM (*izd.* 94A)	c.1970	
2358 Black	MiG-21PFM (*izd.* 94A)	c.1970	Silver overall. Spurious serial, preserved Luxor
5364	MiG-21PFM (*izd.* 94A)	c.1970	
5463	MiG-21PFM (*izd.* 94A)	c.1970	
5620	MiG-21PFM (*izd.* 94A)	c.1970	Sent to USA for testing in early 1980s
5634	MiG-21PFM (*izd.* 94A)	c.1970	
5654	MiG-21PFM (*izd.* 94A)	c.1970	
8312	MiG-21PFM (*izd.* 94A)	c.1970	
8501	MiG-21PFM (*izd.* 94A)	c.1970	

via RART

via RART

via Internet



via RART

Egyptian Air Force MiG-21RF 8501 shows the ventral camera fairing characterising this version.

Known Egyptian Air Force MiG-21PFSs

Serial	Version	Delivery date
8001	MiG-21PFS (*izd.* 94A)	c.1970
8002	MiG-21PFS (*izd.* 94A)	c.1970
8003	MiG-21PFS (*izd.* 94A)	c.1970
8004	MiG-21PFS (*izd.* 94A)	c.1970
8005	MiG-21PFS (*izd.* 94A)	c.1970
8006	MiG-21PFS (*izd.* 94A)	c.1970
8007	MiG-21PFS (*izd.* 94A)	c.1970
8008	MiG-21PFS (*izd.* 94A)	c.1970
8009	MiG-21PFS (*izd.* 94A)	c.1970
8010	MiG-21PFS (*izd.* 94A)	c.1970
8011	MiG-21PFS (*izd.* 94A)	c.1970
8012	MiG-21PFS (*izd.* 94A)	c.1970
8013	MiG-21PFS (*izd.* 94A)	c.1970
8014	MiG-21PFS (*izd.* 94A)	c.1970
8015	MiG-21PFS (*izd.* 94A)	c.1970
8016	MiG-21PFS (*izd.* 94A)	c.1970
8017	MiG-21PFS (*izd.* 94A)	c.1970
8018	MiG-21PFS (*izd.* 94A)	c.1970
8019	MiG-21PFS (*izd.* 94A)	c.1970
8020	MiG-21PFS (*izd.* 94A)	c.1970
8021	MiG-21PFS (*izd.* 94A)	c.1970
8022	MiG-21PFS (*izd.* 94A)	c.1970
8023	MiG-21PFS (*izd.* 94A)	c.1970
8024	MiG-21PFS (*izd.* 94A)	c.1970
8025 Black *	MiG-21PFS (*izd.* 94A)	c.1970
8026	MiG-21PFS (*izd.* 94A)	c.1970
8027	MiG-21PFS (*izd.* 94A)	c.1970
8028	MiG-21PFS (*izd.* 94A)	c.1970
8029	MiG-21PFS (*izd.* 94A)	c.1970
8030	MiG-21PFS (*izd.* 94A)	c.1970
8031	MiG-21PFS (*izd.* 94A)	c.1970
8032	MiG-21PFS (*izd.* 94A)	c.1970
8033	MiG-21PFS (*izd.* 94A)	c.1970
8034	MiG-21PFS (*izd.* 94A)	c.1970
8035	MiG-21PFS (*izd.* 94A)	c.1970
8036	MiG-21PFS (*izd.* 94A)	c.1970
8037	MiG-21PFS (*izd.* 94A)	c.1970
8038	MiG-21PFS (*izd.* 94A)	c.1970
8039	MiG-21PFS (*izd.* 94A)	c.1970
8040 White †	MiG-21PFS (*izd.* 94A)	c.1970
8041	MiG-21PFS (*izd.* 94A)	c.1970
8042	MiG-21PFS (*izd.* 94A)	c.1970
8043	MiG-21PFS (*izd.* 94A)	c.1970
8044	MiG-21PFS (*izd.* 94A)	c.1970
8045	MiG-21PFS (*izd.* 94A)	c.1970
8046	MiG-21PFS (*izd.* 94A)	c.1970
8047	MiG-21PFS (*izd.* 94A)	c.1970
8048	MiG-21PFS (*izd.* 94A)	c.1970
8049	MiG-21PFS (*izd.* 94A)	c.1970
8050	MiG-21PFS (*izd.* 94A)	c.1970
8051	MiG-21PFS (*izd.* 94A)	c.1970
8052	MiG-21PFS (*izd.* 94A)	c.1970
8053	MiG-21PFS (*izd.* 94A)	c.1970
8054	MiG-21PFS (*izd.* 94A)	c.1970
8055	MiG-21PFS (*izd.* 94A)	c.1970
8056	MiG-21PFS (*izd.* 94A)	c.1970
8057	MiG-21PFS (*izd.* 94A)	c.1970
8058	MiG-21PFS (*izd.* 94A)	c.1970
8059	MiG-21PFS (*izd.* 94A)	c.1970
8060	MiG-21PFS (*izd.* 94A)	c.1970
8061	MiG-21PFS (*izd.* 94A)	c.1970
8062	MiG-21PFS (*izd.* 94A)	c.1970
8063	MiG-21PFS (*izd.* 94A)	c.1970
8064	MiG-21PFS (*izd.* 94A)	c.1970
8065 Black *	MiG-21PFS (*izd.* 94A)	c.1970*
8066	MiG-21PFS (*izd.* 94A)	c.1970
8067 Black ‡	MiG-21PFS (*izd.* 94A)	c.1970
8068	MiG-21PFS (*izd.* 94A)	c.1970
8069	MiG-21PFS (*izd.* 94A)	c.1970
8070	MiG-21PFS (*izd.* 94A)	c.1970
8071	MiG-21PFS (*izd.* 94A)	c.1970
8072 §	MiG-21PFS (*izd.* 94A)	c.1970
8073	MiG-21PFS (*izd.* 94A)	c.1970
8074	MiG-21PFS (*izd.* 94A)	c.1970
8075 Black **	MiG-21PFS (*izd.* 94A)	c.1970

* Tan/green camouflage

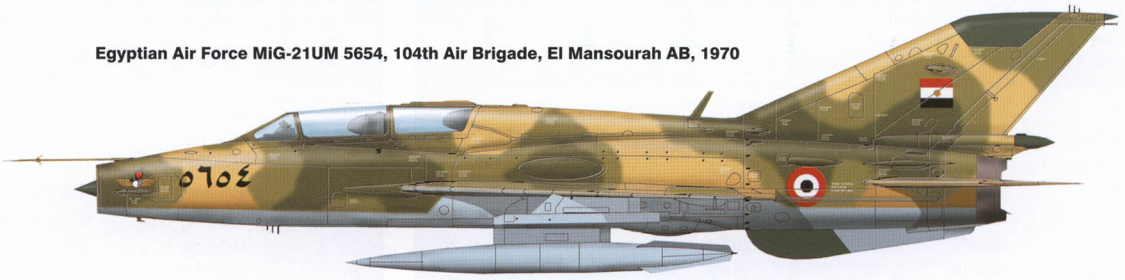
† Preserved 1973 October War Panorama near Cairo, spurious brown/yellow camouflage

‡ Silver overall. Preserved at an Egyptian airbase

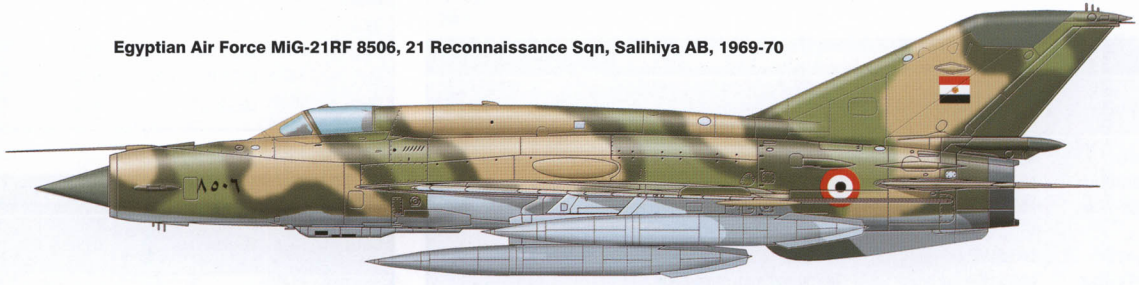
§ Preserved 1973 October War Panorama near Cairo

** Tan/green/brown camouflage

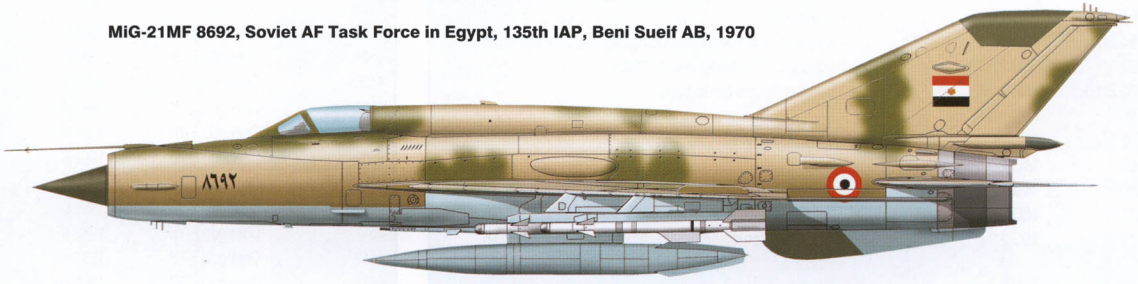
Egyptian Air Force MiG-21UM 5654, 104th Air Brigade, El Mansourah AB, 1970



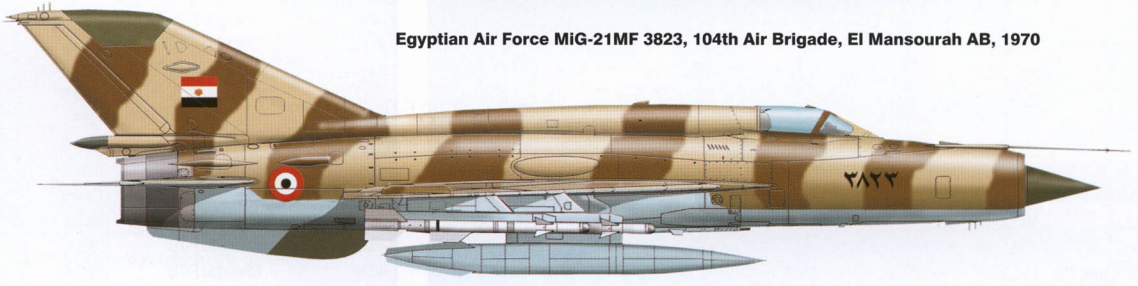
Egyptian Air Force MiG-21RF 8506, 21 Reconnaissance Sqn, Salihiya AB, 1969-70



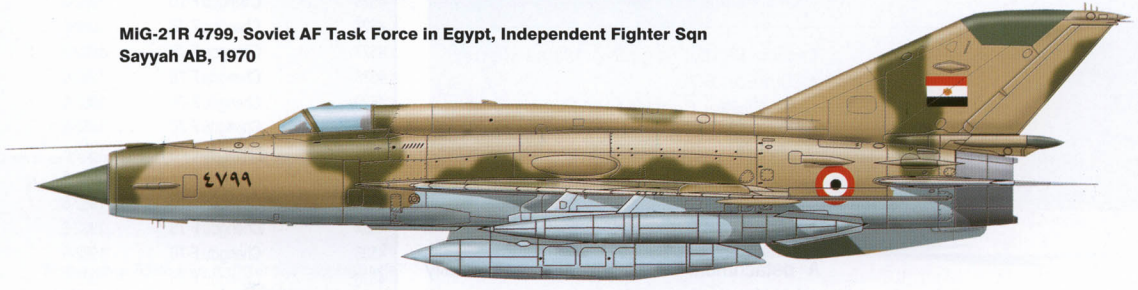
MiG-21MF 8692, Soviet AF Task Force in Egypt, 135th IAP, Beni Sueif AB, 1970



Egyptian Air Force MiG-21MF 3823, 104th Air Brigade, El Mansourah AB, 1970



MiG-21R 4799, Soviet AF Task Force in Egypt, Independent Fighter Sqn
Sayyah AB, 1970



Known Egyptian Air Force MiG-21RFs

Serial	Version	Delivery date	Unit	Comments
1501	MiG-21RF	1971		
8501 Black	MiG-21RF	1971	21 Sqn	Tan/green/brown camouflage
8502 Black	MiG-21RF	1971	26 Sqn	Tan/green/brown camouflage
8503	MiG-21RF	1971	26 Sqn	
8504	MiG-21RF	1971	26 Sqn	
8505	MiG-21RF	1971	26 Sqn	
8506 Black	MiG-21RF	1971	26 Sqn	Tan/green/brown camouflage

Known Egyptian Air Force MiG-21MFs

Serial	Version	Unit	Comments
8116	MiG-21MF		Noted 2005
8212 Black	MiG-21MF		Green/tan camouflage
8226 White	MiG-21MF		Noted 2005, tan/green/brown camouflage plus orange fin, wingtips and fuselage spine
8410	MiG-21MF		
8424 Black	MiG-21MF		Tan/green/brown camouflage
8427	MiG-21MF		
8451	MiG-21MF		Noted 2005
8454 Black	MiG-21MF		Tan/green camouflage plus orange fin and fuselage spine
8457	MiG-21MF		Sent to USA for testing in early 1980s
8460 Black	MiG-21MF		Tan/green/brown camouflage
8501	MiG-21MF		
8502	MiG-21MF		
8522	MiG-21MF		
8610	MiG-21MF		
8611	MiG-21MF		
8618 White	MiG-21MF		Noted 2005, tan/green/brown camouflage plus orange fin, wingtips and fuselage spine
8627	MiG-21MF		
8632	MiG-21MF		
8652	MiG-21MF		
8654	MiG-21MF		
8661	MiG-21MF		Noted 2004
8666	MiG-21MF		
8668	MiG-21MF		Noted 2005
8676	MiG-21MF		
8678	MiG-21MF		Noted 2006
8686	MiG-21MF		
8688	MiG-21MF		
8691 Black	MiG-21MF	26 AB	Tan/green camouflage
8692 Black	MiG-21MF	22 AB	Tan/green camouflage

Tactical Fighter Brigade at Mersa-Matruh:
- 26th Sqn F-7B

104th Fighter Brigade at Al Mansoura:
- 22nd Sqn F-7B

45th Sqn MiG-21MF
49th Sqn MiG-21MF
Fighter Brigade at Assouan
? Sqn MiG-21MF

A detachment of MiG-21MFs is normally based at Hurghada.

Known Egyptian Air Force MiG-21Ms

Serial	Version	Delivery date
8301	MiG-21M	1972-3
8302	MiG-21M	1972-3
8303	MiG-21M	1972-3
8304	MiG-21M	1972-3
8305	MiG-21M	1972-3
8306	MiG-21M	1972-3
8307	MiG-21M	1972-3
8308	MiG-21M	1972-3
8309	MiG-21M	1972-3
8310	MiG-21M	1972-3
8311	MiG-21M	1972-3
8312	MiG-21M	1972-3

Known Egyptian Air Force F-7Bs

Serial	Version	Delivery date
4501	Chengdu F-7B	1982-6
4502	Chengdu F-7B	1982-6
4503	Chengdu F-7B	1982-6
4504	Chengdu F-7B	1982-6
4506	Chengdu F-7B	1982-6
4507	Chengdu F-7B	1982-6
4508	Chengdu F-7B	1982-6
4509	Chengdu F-7B	1982-6
4509	Chengdu F-7B	1982-6
4510	Chengdu F-7B	1982-6
4511	Chengdu F-7B	1982-6
4512	Chengdu F-7B	1982-6
4513	Chengdu F-7B	1982-6
4514	Chengdu F-7B	1982-6
4515	Chengdu F-7B	1982-6
4516	Chengdu F-7B	1982-6
4517	Chengdu F-7B	1982-6
4518	Chengdu F-7B	1982-6
4519	Chengdu F-7B	1982-6
4520	Chengdu F-7B	1982-6
4521	Chengdu F-7B	1982-6
4522	Chengdu F-7B	1982-6
4523	Chengdu F-7B	1982-6
4524	Chengdu F-7B	1982-6
4525	Chengdu F-7B	1982-6
4526	Chengdu F-7B	1982-6
4527	Chengdu F-7B	1982-6
4528	Chengdu F-7B	1982-6
4529	Chengdu F-7B	1982-6
4530	Chengdu F-7B	1982-6
4531	Chengdu F-7B	1982-6
4532	Chengdu F-7B	1982-6
4533	Chengdu F-7B	1982-6
4534	Chengdu F-7B	1982-6
4535	Chengdu F-7B	1982-6
4536	Chengdu F-7B	1982-6

4537	Chengdu F-7B	1982-6
4538	Chengdu F-7B	1982-6
4539	Chengdu F-7B	1982-6
4540	Chengdu F-7B	1982-6
4541	Chengdu F-7B	1982-6
4542	Chengdu F-7B	1982-6
4543	Chengdu F-7B	1982-6
4544	Chengdu F-7B	1982-6
4545	Chengdu F-7B	1982-6
4546	Chengdu F-7B	1982-6
4547 Black *	Chengdu F-7B	1982-6
4548	Chengdu F-7B	1982-6
4549	Chengdu F-7B	1982-6
4550	Chengdu F-7B	1982-6
4551	Chengdu F-7B	1982-6
4552	Chengdu F-7B	1982-6
4553	Chengdu F-7B	1982-6
4554	Chengdu F-7B	1982-6
4555	Chengdu F-7B	1982-6
4556 **	Chengdu F-7B	1982-6
4557	Chengdu F-7B	1982-6
4558	Chengdu F-7B	1982-6
4559	Chengdu F-7B	1982-6
4560	Chengdu F-7B	1982-6
4561	Chengdu F-7B	1982-6
4562	Chengdu F-7B	1982-6
4563	Chengdu F-7B	1982-6
4564	Chengdu F-7B	1982-6
4565	Chengdu F-7B	1982-6
4566	Chengdu F-7B	1982-6
4567	Chengdu F-7B	1982-6
4568	Chengdu F-7B	1982-6
4569	Chengdu F-7B	1982-6
4570	Chengdu F-7B	1982-6
4571	Chengdu F-7B	1982-6
4572	Chengdu F-7B	1982-6
4573	Chengdu F-7B	1982-6
4574	Chengdu F-7B	1982-6
4575	Chengdu F-7B	1982-6
4576	Chengdu F-7B	1982-6
4577	Chengdu F-7B	1982-6
4578	Chengdu F-7B	1982-6
4579	Chengdu F-7B	1982-6
4580	Chengdu F-7B	1982-6

* 104 Fighter-Bomber Sqn, two-tone grey camouflage
** 104 Fighter-Bomber Sqn

Known Egyptian Air Force MiG-21US/UM trainers

Serial	Version	C/n	Delivery date	Comments
5641	MiG-21US	?	c.1970	
5642 Black	MiG-21US	?	c.1970	Tan/green camouflage
5643	MiG-21US	?	c.1970	
5644	MiG-21US	07685154	c.1970	
5645	MiG-21US	?	c.1970	
5646	MiG-21US	?	c.1970	
5647	MiG-21US	?	c.1970	
5648	MiG-21US	?	c.1970	
5649	MiG-21US	?	c.1970	
5650	MiG-21US	?	c.1970	
5651	MiG-21US	?	c.1970	
5652	MiG-21US	?	c.1970	
5653	MiG-21US	?	c.1970	
5654 Black	MiG-21US	?	c.1970	Tan/green/brown camouflage
5655	MiG-21US	?	c.1970	
5656	MiG-21US	?	c.1970	
5657	MiG-21US	?	c.1970	
5658 White	MiG-21UM	?	c.1970	Grey/black with orange fin, wingtips and fuselage spine
5659	MiG-21US	?	c.1970	
5660	MiG-21US	?	c.1970	
5661	MiG-21US	?	c.1970	
5662	MiG-21US	?	c.1970	
5663	MiG-21US	?	c.1970	
5664	MiG-21US	?	c.1970	

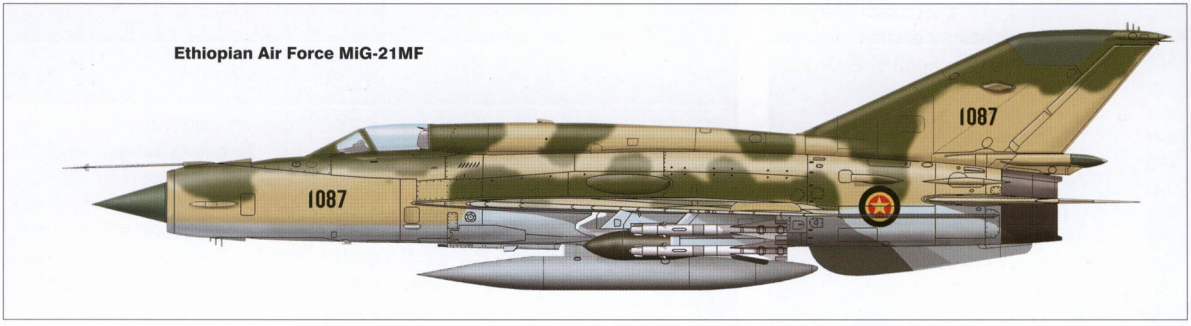
Note: Some aircraft flown in Egyptian markings were in fact Soviet-operated. Some of them may have returned to the USSR after the Soviet withdrawal from Egypt and are thus not included in the tables.

via Internet

►▲ One more view of 8506 with three drop tanks and two AAMs.

via Internet

► Sister ship 8506 has a different camouflage scheme and wears the serial in smaller digits.



Eritrea

Until 24th May 1993 Eritrea had been a province of Ethiopia and for the previous 30 or more years its citizens had been involved in a bloody guerrilla war, fighting for their independence. In the aftermath of the civil war the Eritreans found, amongst other trophies, nine Ethiopian MiG-21s at Asmara airport. None of them were returned to airworthy condition or taken into the stock of the Eritrean Air Force (ErAF). The MiG-21s are listed in the section on the Ethiopian Air Force. No MiG-21 fighters were acquired by the ErAF; the story that six had been purchased from Moldavia has never been substantiated but the ErAF did take delivery of eight MiG-29s in 1998.

Ethiopia

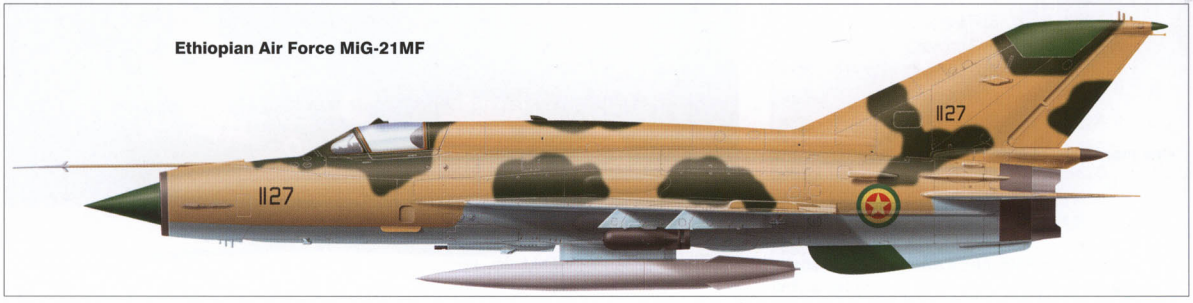
On 13th September 1974 Haile Selassie Emperor of Ethiopia was deposed, the country declared a Republic and the Imperial Ethiopian Air Force, which originated in 1924, was renamed *Ye Ityopya Ayer Hayl* (**Ethiopian Air Force**, EtAF). In 1977 the new President Mengistu Haile Mariam, unable to obtain more supplies from the USA, turned to the USSR for help in suppressing the rebellion in Eritrea province and the Somali invasion of the Ogaden province. The first fighters to arrive were 20 MiG-17s in 1977, followed by 48 MiG-21MFs (*izdeliye* 96F) at the end of that year and in early 1978; some sources suggest that as many as 36 were supplied from Cuba, probably via Angola, together with some pilots. The total of 48 presumably included some MiG-21UM (*izdeliye* 69A) trainers. By December 1978, the 1st and 2nd Fighter Squadrons (FS) had re-equipped with MiG-21MFs; one of the squadrons was provided with pilots and aircraft from Cuba.

More deliveries of MiG-21MFs were undertaken in 1982-83 the number estimated to be at least 50 and possibly as many as 150. Included in this total were substantial numbers of MiG-21UMs and at least four MiG-21R (*izdeliye* 94R) tactical reconnaissance aircraft. Attrition was very high due to inexperienced local pilots and the subsequent wars – first against Eritrean guerrillas and then, from 1991, the Eritrean army and air force.

30 MiG-21*bis* (*izdeliye* 75A) fighters were delivered between 1986 and 1988. After the triumph of the Eritrean rebels and the capture of Addis Ababa the EtAF languished; about 20 MiG-21 fighters remained intact but in poor condition and its pilots were imprisoned or fled

via Internet

▶ **A line-up of Ethiopian MiG-21s at Asmara airport (left to right: MiG-21*bis* 1127, MiG-21MF 1082 and MiG-21Rs 1461 and 1464).**



abroad. Two years after the secession of Eritrea in 1993, a new democratically elected Ethiopian government started to revive the EtAF. Ten MiG-21s were sent to Israel for refurbishing and possible upgrading in 1997 but shortage of funds subsequently precluded the latter (though some sources do state that the EtAF operated MiG-21-2000 fighter-bombers). This proved successful enough in the next war between the two countries that started in 1998, occasioned by border disputes over the Badme region. Thanks also to the menacing importation of eight Sukhoi Su-27 (including two Su-27UB two-seaters), the war ended on 18th June 2000 in a ceasefire with a Pyrrhic victory for the Ethiopians.

By mid-2007 two 'regiments' of MiG-21 fighters were reported to be based at Dire Dawa (3 Air Regiment) and Debre Zeit, equipped with about 18 fighters and six trainers.

Known Ethiopian Air Force MiG-21MFs, MiG-21UMs and MiG-21Rs

Black Serial	Type	Comments
1002	MiG-21UM?	
1005	MiG-21UM?	
1012	MiG-21UM	
1013	MiG-21MF	
1014	MiG-21MF	
1050	MiG-21MF	
1054	MiG-21MF	
1058	MiG-21MF	Captured at Asmara airport, taken over by ErAF, stored, present 1994
1060	MiG-21MF	
1064	MiG-21MF	
1065	MiG-21MF	Captured at Asmara airport, taken over by ErAF, stored, present 1994
1080	MiG-21MF	
1082	MiG-21MF	Captured at Asmara airport, taken over by ErAF, stored, present 1994
1083	MiG-21MF	Refurbished in Israel 1997; shot down 6-6-1998
1454	MiG-21R	
1455	MiG-21R	Captured at Asmara airport, taken over by ErAF, stored, present 1994
1461	MiG-21R	Captured at Asmara airport, taken over by ErAF, stored, present 1994
1464	MiG-21R	Captured at Asmara airport, taken over by ErAF, stored, present 1994

Known Ethiopian Air Force MiG-21*bis* fighters

Serial	Version	Comments
1087	MiG-21*bis*?	May be MiG-21MF; noted 1998; refurbished in Israel
1091	MiG-21*bis*?	May be MiG-21MF
1095	MiG-21*bis* (*izd.* 75B)	
1098	MiG-21*bis*	
1103	MiG-21*bis*	
1106	MiG-21*bis*	
1114	MiG-21*bis*	Noted mid-1980s
1117	MiG-21*bis*	
1127	MiG-21*bis*	Captured at Asmara airport, taken over by ErAF, stored, present 1994
1129	MiG-21*bis*	Captured at Asmara airport, taken over by ErAF, stored, present 1994
1134	MiG-21*bis*	
5107	MiG-21*bis*	

Finland

On 6th March 1918, three months after Finland's declaration of independence, the **Finnish Air Force** (*Suomen Ilmavoimat*) was created when Count Eric von Rosen donated a Morane Saulnier Type D parasol monoplane built by Thulin. The aircraft carried the Count's blue swastika as a good luck charm and this was adopted by the Finnish Air Force as its national insignia until changed in 1945 for blue and white roundels.

Finnish pilots started their initial conversion training to the MiG-21F-13 in the Soviet Union on late 1962. On 24th April 1963 the first ten of an eventual 22 Moscow-built MiG-21F-13s (*izdeliye* 74) fighters were ferried to Kuopio-Rissala AB in Karelia by Soviet pilots, followed by a further eleven in November same year; one more was procured in 1965 as an attrition replacement.

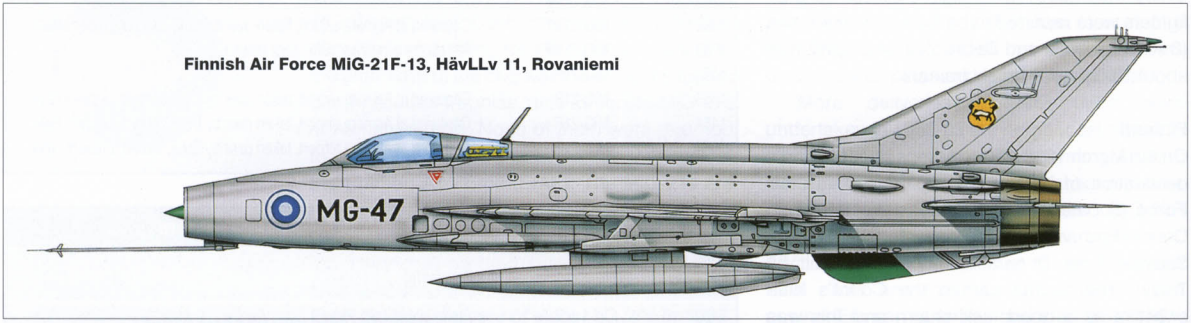
Jurki Laukkanen

Overleaf: MiG-21F-13 MG-77 in flight in August 1985. Note the original unit badge of HävLLv 31.

◄

MiG-21F-13 MG-35 taxies at Kuopio-Rissala AB in May 1985. This aircraft was later converted to a decoy, becoming 'MG-135'.

Jurki Laukkanen



Finnish Air Force MiG-21s

Serial	Version	C/n	Delivery date	First unit	Comments
MG-31	MiG-21F-13	740305	24-4-63	HävLLv 31	Originally MG-1. Converted to decoy, to Kuopio-Rissala; serial 'MG-131' allocated but not applied; noted scrapped Halli 5-1999
MG-32	MiG-21F-13 *	740401	24-4-63	HävLLv 31	Originally MG-2. To TiedLLv. Converted to decoy as 'MG-129', to Luonetjärvi; stored Halli, noted 6-1998
MG-33	MiG-21F-13	740403	24-4-63	HävLLv 31	Originally MG-3. Converted to decoy as 'MG-133', to Kuopio-Rissala; scrapped Halli 5-1999
MG-34	MiG-21F-13	740404	24-4-63	TiedLLv	Originally MG-4. Converted to decoy as 'MG-124', to Halli, scrapped there; front fuselage preserved at Karhula, other parts noted Halli 5-1999
MG-35	MiG-21F-13 *	740405	24-4-63	HävLLv 31	Originally MG-5. To TiedLLv. Converted to decoy as 'MG-135'; stored Utti, noted 6-2004
MG-46	MiG-21F-13	740406	24-4-63	HävLLv 31	Originally MG-6. Converted to decoy as 'MG-116', to Halli, noted scrapped there 5-1999
MG-47	MiG-21F-13 *	740407	24-4-63	HävLLv 31	Originally MG-7. Operated by HävLLv 11 for a while. To TiedLLv. Converted to decoy as 'MG-117', to Halli, noted scrapped there 5-1999
MG-48	MiG-21F-13	740408	24-4-63	HävLLv 31	Originally MG-8. Converted to decoy as 'MG-118', to Halli, noted scrapped there 5-1999
MG-49	MiG-21F-13 *	740409	24-4-63	HävLLv 31	Originally MG-9. To TiedLLv. Converted to decoy as 'MG-119', to Pirkkala, scrapped Halli 8-8-2001
MG-50	MiG-21F-13 *	740410	24-4-63	HävLLv 31	Originally MG-10. To TiedLLv. Converted to decoy as 'MG-140' (prototype conversion), noted scrapped Halli 5-1999
MG-61	MiG-21F-13 *	741117	11-1963	HävLLv 31	To TiedLLv, later to FTC. Preserved as gate guard Kuopio airport
MG-62	MiG-21F-13	741119	11-1963	HävLLv 31	Crashed Pielavesi 2-7-1971
MG-63	MiG-21F-13 *	741120	11-1963	HävLLv 31	To TiedLLv. Crashed Juankoski 19-11-1977 after landing gear failure
MG-64	MiG-21F-13	741201	11-1963	HävLLv 31	Crashed Kallavesi (or Kotka?) 20-5-1964 after engine failure
MG-65	MiG-21F-13 *	741202	11-1963	HävLLv 31	To TiedLLv. Converted to decoy as 'MG-125', to Halli, noted scrapped there 5-1999
MG-76	MiG-21F-13	741203	11-1963	HävLLv 31	To FTC. Written off or crashed 3-3-1976
MG-77	MiG-21F-13	741204	11-1963	TiedLLv	Converted to decoy as 'MG-127', to Pirkkala, green/brown camouflage. Preserved Helsinki-Vantaa
MG-78	MiG-21F-13	741205	11-1963	HävLLv 31	Preserved Karhula Flying Club Museum, Kymi
MG-79	MiG-21F-13	741206	11-1963	HävLLv 31	Crashed Sillinjärvi 8-9-1975

MG-80	MiG-21F-13	741207	11-1963	HävLLv 31	To FTC. Crashed Joroinen 6-5-1970
MG-91	MiG-21F-13	741208	11-1963	HävLLv 31	Converted to decoy as 'MG-114', to Halli, noted scrapped there 5-1999
MG-92	MiG-21F-13 *	741721	10-1965!	HävLLv 31	Supplied as replacement for MG-64. To TiedLLv. Last flight of any Finnish MiG-21F-13 17-1-1986, preserved Finnish Air Force Museum, Tikkakoski
MK-103	MiG-21U (*izd.* 66-400)	661416	1-4-65	HävLLv 31	Overall silver finish. Last flight 29-5-1981, used for brake parachute testing; preserved Finnish Air Force Museum
MK-104	MiG-21U (*izd.* 66-400)	661417	1-4-65	HävLLv 31	Last flight to Halli 29-5-1981, used as ground instructional airframe, then converted to decoy as 'MK-106'; noted scrapped Halli 5-1999
MK-105	MiG-21UM	516917001	18-6-74	HävLLv 31	Green/brown camouflage, repainted grey 3-1991. Swapped wings with camouflaged MK-143 during maintenance 1-1995. Preserved Helsinki-Vantaa
MK-106	MiG-21UM	516917006	18-6-74	HävLLv 31	Late green/brown camouflage, repainted in two-tone green camouflage 12-1990. Last flight 8-1997. Noted stored Halli 7-1998
MG-111	MiG-21*bis*	75064540	21-9-78	HävLLv 31	Originally MB-111, early green/brown camouflage. Last flight 24-8-1993, preserved Helsinki-Vantaa
MG-114	MiG-21*bis*/T	75064587	21-9-78	HävLLv 31	Originally MB-114. To TiedLLv, MiG-21bis/T prototype; back to HävLLv 31 1995, then instructional airframe, noted 3-2004 at Pori; two-tone green camouflage
MG-115	MiG-21*bis*	75083858	?-6-80	HävLLv 31	Crashed Anttola 24-8-1984 after engine failure
MG-116	MiG-21*bis*	75083895	?-6-80	HävLLv 31	Early green/brown camouflage, then two-tone green camouflage by 1991. Preserved Karhula Flying Club Museum, Kymi
MG-117	MiG-21*bis*	75083914	?-6-80	HävLLv 31	Early green/brown camouflage. Crashed Sotkamo 5-11-1991
MG-118	MiG-21*bis*	75083945	?-6-80	HävLLv 31	Two-tone green camouflage by 1993. Instructional airframe Kuahava noted 6-2004
MG-119	MiG-21*bis*	75098121	?-2-85	HävLLv 31	Delivered as 'MG-118'. Early green/brown camouflage, then late green/brown camouflage. Preserved Kuopio-Rissala AB
MG-120	MiG-21*bis*	75083978	?-6-80	HävLLv 31	Crashed Juankoski 30-9-1986
MG-121	MiG-21*bis*	75098132	?-7-86	HävLLv 31	Delivered as 'MG-124'. Green/black camouflage. Noted as instructional airframe Halli 6-1997
MG-122	MiG-21*bis*	75084145	17-7-80	HävLLv 31	Early green/brown camouflage. Crashed Maainka 22-3-1995
MG-123	MiG-21*bis*	75098140	?-7-86	HävLLv 31	Delivered as 'MG-126'. Green/black camouflage 1993, then late green/brown camouflage. Noted stored Halli 6-2004 in poor condition
MG-124	MiG-21*bis*/T	75084151	17-7-80	TiedLLv	HävLLv 31 1995, noted 6-1999 preserved Air Force Technical School, Halli AB. Green/black camouflage
MG-125	MiG-21*bis*/T	75084204	17-7-80	TiedLLv	Late green/brown camouflage. HävLLv 31 1995 then instructional airframe; noted Kuopio in the city 8-2004
MK-126 (1)	MiG-21UM	516999378	25-9-81	HävLLv 31	Overall grey finish instead of camouflage. Not accepted due to defects, returned to USSR 6-1982; see next line
MK-126 (2)	MiG-21UM	516999410	9-9-82	HävLLv 31	Delivered by rail to Vainikkala, thence by road to Kuopio-Rissala 12-9-1982; f/f 23-9-1982, accepted 15-9-1982. Green/brown camouflage, later two-tone green camouflage. Preserved Finnish Air Force Museum
MG-127	MiG-21*bis*/T	75084215	?-6-80	HävLLv 31	Preserved Lappeenranta
MG-128	MiG-21*bis*	75098124	?-2-85	HävLLv 31	Delivered as 'MG-127'. Early green/brown camouflage, then two-tone green camouflage by 1992. Crashed 11-11-1992 Tammisaari
MG-129	MiG-21*bis*/T	75084300	17-7-80	TiedLLv	HävLLv 31 1995, noted as GIA at tech school, Kuopio airport, 6-2004. Early green/brown camouflage, then late green/brown camouflage
MG-130	MiG-21*bis*	75084403	17-7-80	HävLLv 31	Early green/brown camouflage, then late green/brown camouflage. Stored Menkijärvi
MG-131	MiG-21*bis*	75084511	17-7-80	HävLLv 31	Early green/brown camouflage. To FTC 2-1988. Preserved FTC, Halli AB
MG-132	MiG-21*bis*	75084542	10-9-80	HävLLv 31	Early green/brown camouflage. Noted as withdrawn from use Halli 10-2004, later scrapped
MG-133	MiG-21*bis*/T	75084545	10-9-80	TiedLLv	HävLLv 31 1995, preserved Halli
MG-134	MiG-21*bis*	75098143	?-7-86	HävLLv 31	Delivered as 'MG-132'. Early green/brown camouflage (later with new-style insignia). Preserved Kuopio-Rissala
MG-135	MiG-21*bis*	75084554	10-9-80	HävLLv 31	Early green/brown camouflage, then late green/brown camouflage. Preserved Helsinki-Vantaa
MG-136	MiG-21*bis*	75098129	?-2-85	HävLLv 31	Delivered as 'MG-135'. Scrapped, front fuselage preserved Finnish Air Force Museum
MG-138	MiG-21*bis*	75084608	10-9-80	HävLLv 31	Early green/brown camouflage, then late green/brown camouflage, then two-tone green camouflage, named 'Ylli'. Preserved Finnish Air Force Museum
MG-139	MiG-21*bis*	75084622	10-9-80	HävLLv 31	Crashed Kiuruvesi 11-6-1982
MG-140	MiG-21*bis*	75084645	10-9-80	HävLLv 31	Early green/brown camouflage. Noted 10-2004 preserved at Vesivehmaa
MK-143 (1)	MiG-21UM	516999379	25-9-81	HävLLv 31	Overall grey finish instead of camouflage. Not accepted due to defects, returned to USSR 6-1982; see next line
MK-143 (2)	MiG-21UM	516999411	9-9-82	HävLLv 31	Delivered by rail to Vainikkala, thence by road to Kuopio-Rissala 12-9-1982; f/f 27-9-1982, accepted 15-9-1982. Early green/brown camouflage. Last flight 14-12-1993. wings refitted to MK-105 1-1995. Scrapped Halli 17-5-1999

HävLLv 31

▲
The old badge of HävLLv 31 (top) and the badge of HävLLv 11.

MiG-21U MK-104 is seen at the Finnish Air Force Museum in Tikkakoski in March 1993. Note the new 'leaping lynx' unit badge of HävLLv 31.
▼

MiG-21UM MK-143 seen here in October 1992 shows the small roundels and small serial introduced in the late 1980s.
▼▼

Two MiG-21U (*izdeliye* 66-400) trainers arrived on 1st April 1965. The single-seaters had serials prefixed MG (derived from 'MiG'), while those of the trainers were prefixed MK (meaning *MiG kaksipaikkaiset* – 'two-seat MiG'); in the Finnish Air Force the single-seater and the trainer were short-coded MGF and MKU respectively.

The two variants ultimately equipped *Hävittäjälentolaivue* 31 (31st Fighter Squadron, HävLLv) based at Kuopio-Rissala AB, which started MiG-21 operations on 9th May 1963. When deliveries were completed, it suddenly came to light that the unit had more fighters than it could operate or had hangar space for, and six aircraft were placed in storage at Jyväskylä-Luonetjärvi. As a temporary measure, some MiG-21F-13s were later sent to HävLLv 11 at Rovaniemi, where they stayed until the arrival in 1972 of the SAAB 35BS Draken.

In 1971-73 nine of the MiG-21F-13s were modified for photo reconnaissance duties, carrying two Vinten camera pods under the wings. Such aircraft were short-coded MGT (for *tiedusteluversio* – reconnaissance version) and are marked * in the table. These aircraft were transferred to the Reconnaissance Squadron (*Tiedustelulentolaivue*, TiedLLv) at Jyväskylä-Luonetjärvi; the unit was formally established on 1st September 1973, yet the recce version became operational as early as April 1973. From 1980 onwards, as HävLLv 31 reequipped with the MiG-21*bis*, all surviving MiG-21F-13s were progressively transferred to TiedLLv, though not all of them were equipped for reconnaissance duties.

Three MiG-21F-13s (not more than one at any one time) were operated by the Air Force's Flight Test Centre (FTC) at Halli and outfitted with test and recording equipment.

The last flight of a Finnish MiG-21F-13 took place on 17th January 1986; the honour fell to MG-92. Starting in 1985, 14 of the retired fighters were converted to decoys to be placed on the outskirts of aircraft parking areas. This involved removing the engine, stripping out all equipment and cutting up the wings and tail so that they could be folded to ease transportation by road. The converted aircraft received bogus serials and a MiG-21*bis*-style camouflage.

The type was succeeded in HävLLv 31 service by the 26 MiG-21*bis* (*izdeliye* 75A) fighters, which were ordered in late 1977 and began to arrive in Finland on 21st September 1978. The type was selected over the MiG-23MS, which was too expensive and maintenance-heavy; besides, the MiG-21*bis* would be easier to master in view of the Finnish Air Force's prior experience with the MiG-21F-13. The new

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▲
MiG-21*bis* MG-116 in the penultimate camouflage in January 1995.

▲
The Finnish 'Danger, ejection seat' warning triangle and the 'leaping lynx' tail emblem of HävLLv 31 worn by the MiG-21s.

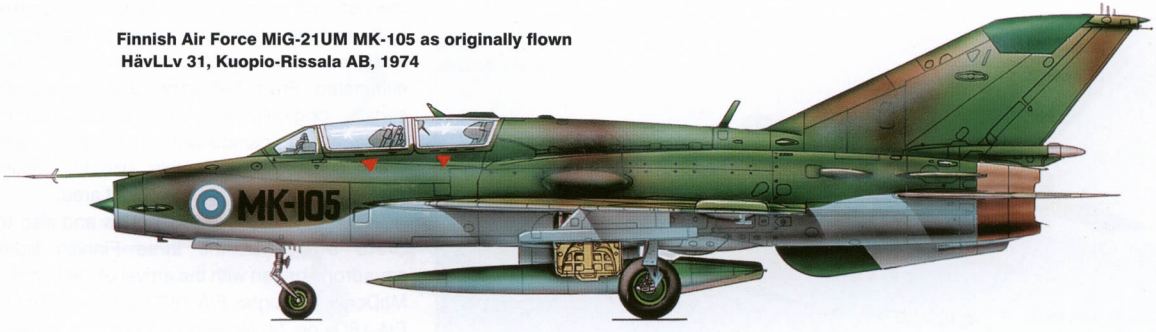
▲◀
MiG-21*bis* MG-128 seen in July 1992 shows the final camouflage scheme applied to the type.

version was short-coded MGB. The initial order was for 20 aircraft, followed by a second order for three in December 1984 and three more in 1985. Curiously, all aircraft arrived with the serials already applied; with the final six MiG-21*bises* the Finns played a counter-intelligence trick, requesting false serials which were promptly changed on delivery (see table).

The Finnish company Valmet at Halli refitted all of the *bises* with Western communications/navigation equipment and flight instruments. MG-114 was the first to be thus modified in February 1979.

Six of the new arrivals were modified in Finland for reconnaissance missions, using a Vinten external camera pod on the centreline pylon, and unofficially given the local designation **MiG-21*bis*/T** (for *tiedusteluversio*; short-coded MGBT). They served with the TiedLLv at Jyväskylä-Luonetjärvi. These aircraft had Italian Electronica SpA radar warning receivers fitted in 1987, with small MiG-21R-style wingtip fairings

Finnish Air Force MiG-21UM MK-105 as originally flown HävLLv 31, Kuopio-Rissala AB, 1974



added as a recognition feature. The centreline pylon could also be used for carrying a Philips 9CM120X chaff dispenser pod or a Selenia SL/ALQ-234 active jammer pod when the aircraft acted as an electronic warfare 'aggressor' during exercises. All MiG-21*bis*/T aircraft were transferred to HävLLv 31 in 1995 to replace attrition losses of fighters.

Six MiG-21UM (*izdeliye* 69A) trainers were received by the Finnish Air Force between 1976 and 1982. Two of them proved to be defective and were returned to the manufacturer, who supplied replacement aircraft with the same serials, so that a maximum of four was in service at any one time. This version was short-coded MKM.

East German Air Force MiG-21F-13s '619 Red' and '689 Red' formate over the Baltic Sea. ▼

Detlev Grass

The MiG-21F-13s, and initially the MiG-21Us as well, were flown in overall silver finish. Later, the *Ilmavoimat* used a succession of camouflage schemes. To make the aircraft less observable the national insignia were downsized dramatically and the white background to the 'leaping lynx' squadron badge of HävLLv 31 was eliminated. From February 1989 onwards the serials, originally writ large on the centre fuselage on camouflaged examples, were reduced to almost illegible size for security reasons and moved to the cockpit area.

Replacement of the MiG-21*bis* and also the SAAB Draken in the three Finnish fighter squadrons began with the arrival of the first of 57 McDonnell Douglas F/A-18C Hornets and seven F/A-18Ds on 7th November 1995. The surviving

MiG-21*bis* and MiG-21UMs were withdrawn from use in March 1998.

TiedLLv disbanded in late 1996. From 1997 onwards, reconnaissance duties were taken over by British Aerospace Hawk T.51s or T.51As using the same Vinten pods.

Germany

The **East German Air Force** (EGAF), officially called *Luftstreitkräfte und Luftverteidigung der Deutschen Demokratischen Republik* (LSK/LV), was a valued member of the Warsaw Pact and, as such, received modern aircraft shortly after they had entered service in the Soviet Union. The first Soviet Mach 2 interceptor was no exception and the MiG-21F-13 (*izdeliye* 74) arrived in April 1962 for *Jagdfliegergeschwader* 8 'Hermann Matern' (8th Fighter Wing, usually abbreviated to JG 8) at Marxwalde (now renamed back to Neuhardenberg).

Ultimately equipping in various guises six JG and two *Taktische Aufklärungsfliegerstaffel* (Tactical Air Reconnaissance Squadron, TAFS), the MiG-21 played a major role in the EGAF right up to the reunification of East and West Germany on 3rd October 1990. At that point, although 50 MiG-21s had been withdrawn from EGAF service in 1989 as part of a friendly gesture by all WarPac countries, 251 MiG-21s of seven different versions were transferred to the unified Luftwaffe. Not accepted as a standard type, the MiG-21s were rapidly phased out of Luftwaffe service.

The MiG-21F-13's inception into service (with JG 8) began in August 1962. JG 3 'Wladimir Komarow '(the German spelling of the name) at

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◀ **MiG-21F-13 '659 Red' of JG 8 taxies past two sister ships (including '736 Red') at Marxwalde. The flight line is equipped with a centralised refuelling system.**

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EGAF aircraft often had their serial altered for security reasons before publicity photos were taken. Here, camouflaged MiG-21PFs '1908 Red' (flight leader) and '1851 Red' are in reality '908 Red' and '851 Red' with an extra digit temporarily painted on.

East German Air Force MiG-21F-13s

Serial	Version	C/n	In-service	First unit	Comments
604 Red	MiG-21F-13	741008	1-10-63	JG 3	JG 9, JG 3, JAG 15, withdrawn 30-11-1978, reported at Peenemünde Museum?
605 Red	MiG-21F-13	741009	1-10-63	JG 3	JAG 15, AFS 31, withdrawn 18-12-1980, 20-2-1981 OHS Kamenz, scrapped Kamenz 28-6-1993
608 Red	MiG-21F-13	741002	16-10-63	JG 3	JG 9, damaged 28-7-1964, front fuselage MTS Bad Düben as instructional airframe, remainder to AFS 31, withdrawn 30-12-1980, scrapped 23-10-1985
612 Red	MiG-21F-13	740913	1-10-63	JG 3	AFS 31, scrapped 3-1988
617 Red	MiG-21F-13	741003	11-10-63	JG 8	JG 3, crashed 27-7-1965
618 Red	MiG-21F-13	N74211709	9-5-62	JG 8	JG 3, JAG 15, withdrawn 6-1976 to Preschen firing range, scrapped 1995
619 Red	MiG-21F-13	741004	1-10-63	JG 8	Silver overall, later two-tone green camouflage. Accident 29-6-67, exhibited first at JG 3, then Preschen (as '335 Red'), withdrawn 5-11-1982, preserved Laage 9-6-1994 as '335 Red'
620 Red	MiG-21F-13	740904	1-10-63	JG 3	JG 9, JAG 15, written off 10-8-1968
622	MiG-21F-13	740902	1-10-63	JG 3	AFS 31, withdrawn 23-10-1985, as SDHS Holzdorf, then exhibit at JG 1, scrapped 20-5-1994
623 Red	MiG-21F-13	741916	1-8-62	JG 8	JG 3, AFS 31, withdrawn 23-10-1985, to Freibad Forst leisure centre Lausitz, preserved 9-1994 Rothenburg Museum
624 Red	MiG-21F-13	740905	1-8-62	JG 3	AFS 31, withdrawn 23-10-1985, scrapped Trollenhagen 1988
625 Red	MiG-21F-13	741522	28-5-64	JG 8	JAG 15, withdrawn 19-5-1991 after crash landing following a birdstrike
626 Red	MiG-21F-13	741523	28-5-64	JG 8	Crashed 13-12-1964
627 Red	MiG-21F-13	740908	16-10-63	JG 3	JG 9, crashed 23-6-1965
628 Red	MiG-21F-13	741602	1-6-64	JG 8	JAG 15, withdrawn 30-11-1978, to Trollenhagen as SDHS, scrapped 3-1988
629 Red	MiG-21F-13	741917	1-8-62	JG 8	JG 9, JAG 15, AFS 31, silver overall. Withdrawn 15-11-1983, to Dresden for trials, scrapped there 1990
631 Red	MiG-21F-13	741603	1-10-63	JG 8	JG 9, crashed 13-8-1965
633 Red	MiG-21F-13	741918	1-10-63	JG 8	JG 3, JG 9, JG 3, silver overall. Crashed 27-9-1967
635 Red	MiG-21F-13	741524	1-6-64	JG 8	JG 9, JAG 15, withdrawn 30-11-1978, exhibit OHS Kamenz and scrapped there 28-6-1983
637 Red	MiG-21F-13	N74211919	1-8-62	JG 8	JG 3, crashed 4-8-1964
639 Red	MiG-21F-13	N74211922	1-8-62	JG 8	JG 9, JG 3, AFS 31, withdrawn 23-10-1985 and scrapped, nose used for training at MTS Bad Düben
641 Red	MiG-21F-13	741618	23-4-62	JG 8	JG 3, JAG 15, AFS 31, withdrawn 30-12-1980, exhibit Storkow where scrapped 30-9-1994
642 Red	MiG-21F-13	N74211923	1-8-62	JG 8	JG 3, AFS 31, silver overall. Withdrawn 23-10-1985, SDHS Marxwalde, scrapped there 21-6-1993
644 Red	MiG-21F-13	741617	1-6-64	JG 8	JAG 15, withdrawn 30-11-1978, 1980 as SDHS Trollenhagen scrapped there 3-1988
645 Red	MiG-21F-13	N74211924	23-4-62	JG 3	JAG 15, AFS 31, two-tone green camouflage, Q-mark. Withdrawn 20-12-80, preserved at Bautzen Museum, then 1981 Luftwaffe Museum, Berlin, without insignia
649 Red	MiG-21F-13	N74211925	1-8-62	JG 8	JG 3, damaged and scrapped 16-1-1965
652 Red	MiG-21F-13	N74212004	28-7-63	JG 8	Crashed 13-9-1963
654 Red	MiG-21F-13	N74212011	28-7-63	JG 8	Damaged 28-3-1963, withdrawn 18-4-1965, to OHS as a sectioned training airframe, scrapped Kamenz 1978
659 Red	MiG-21F-13	N74211920	7-8-62	JG 8	JG 3, JG 8, silver overall. Accident 12-1964 and withdrawn, scrapped 18-4-69
661 Red	MiG-21F-13	N74212001	7-8-62	JG 8	JG 3, JG 9, silver overall. Withdrawn 30-11-1978, SDHS Marxwalde as '049 Red', scrapped there 21-6-1993
663 Red (1)	MiG-21F-13	N74212002	7-8-62	JG 8	Withdrawn and scrapped 7-1-63 after accident
663 Red (2)	MiG-21F-13	741525	27-5-64	JG 8	JAG 15, withdrawn 30-11-1978, to Cottbus as SDHS and scrapped?

666 Red	MiG-21F-13	741001	18-10-63	JG 3	JG 8, JAG 15, crashed 2-4-1970
669 Red	MiG-21F-13	741601	1-6-64	JG 8	JAG 15, withdrawn 30-11-1978, SDHS Peenemünde, scrapped?
671 Red	MiG-21F-13	741620	16-7-64	JG 8	JG 9, JG 3, JAG 15, withdrawn 1971, preserved Military Museum, Dresden, first as '1801 Red', then as '268 Red'
672 Red	MiG-21F-13	740912	15-8-63	JG 3	JG 8, JAG 15, crashed 25-5-1978
675 Red	MiG-21F-13	740909	1-10-63	JG 3	JG 8, JG 9, JAG 15, silver overall. Crashed 8-8-1968 and subsequently scrapped
676 Red	MiG-21F-13	740910	1-10-63	JG 3	JG 8, JAG 15, withdrawn 29-10-1978, SDHS Cottbus or Holzdorf as '678 Red', scrapped 5-1994
677 Red	MiG-21F-13	741619	28-5-64	JG 3	JAG 15, withdrawn 30-11-1978, SDHS Peenemünde later preserved at museum there
678 Red	MiG-21F-13	741615	15-8-63	JG 8	JG 9, JAG 15, dark green/dark earth camouflage. Withdrawn 10-6-1975, SDHS Cottbus or Holzdorf, scrapped there 20-5-1994
679 Red	MiG-21F-13	740901	1-10-63	JG 3	JG 8, JG 3, JAG 15, withdrawn 30-11-78, preserved Ankum Museum as '696 Red', other sources suggest scrapped 21-6-1993
682 Red	MiG-21F-13	740906	1-10-63	JG 3	JG 8, JAG 15, withdrawn 1-1969?
684 Red	MiG-21F-13	741005	1-10-63	JG 3	JG 8, JG 9, JAG 15, withdrawn 30-11-1978 and scrapped
688 Red	MiG-21F-13	741006	1-10-63	JG 3	JG 8, JG 3, AFS 31, dark green/dark earth camouflage. Withdrawn 23-10-85, SDHS Preschen, preserved Laatzen-Hannover 1991
689 Red	MiG-21F-13	741007	1-10-63	JG 3	JG 8, JAG 15, silver overall. Damaged in forced landing 26-7-1965, Dresden as experimental airframe, withdrawn 1969 and scrapped 20-3-1976
693 Red	MiG-21F-13	740815	1-10-63	JG 3	JG 8, JAG 15, silver overall. Withdrawn 30-11-1978, SDHS Peenemünde and preserved in the museum there 1-9-1993
696 Red	MiG-21F-13	742003	7-8-62	JG 8	JG 9, JAG 15, damaged 1972, withdrawn 16-12-1976 after landing accident, scrapped 24-6-1993
699 Red	MiG-21F-13	741613	1-10-63	JG 8	JG 9, JG 3, crashed in Poland 16-8-1967
701 Red	MiG-21F-13	N74211706	14-5-62	JG 8	JAG 15, withdrawn 30-12-1978 after accident, preserved as gate guardian 15-6-1979 at Rothenburg Barracks as '7011 Red', scrapped 19-5-1994
702 Red	MiG-21F-13	N74212005	1-6-62	JG 8	JG 3, silver overall. Crashed 12-10-1967
705 Red	MiG-21F-13	N74211707	9-5-62	JG 8	Silver overall. Withdrawn 18-4-1966, then training airframe first OHS then Dresden, where it became a monument, later preserved Dresden Airport (EFW)
708 Red	MiG-21F-13	741611	1-6-64	JG 8	JG 9, JG 3, JAG 15, AFS 31, withdrawn 23-10-1985, SDHS Holzdorf, 1994 preserved Luftfahrthistorische Sammlung Finow
710 Red	MiG-21F-13	N74212010	7-8-62	JG 8	Crashed Letschin 30-9-1963
712 Red	MiG-21F-13	741010	1-10-63	JG 3	JAG 15, withdrawn 30-11-1978 SDHS Preschen, later scrapped?
713 Red	MiG-21F-13	740914	17-10-63	JG 3	AFS 31, dark green/dark earth camouflage. Withdrawn 23-10-1985, SDHS Preschen, preserved Lehnin 1994
714 Red	MiG-21F-13	741610	28-5-64	JG 3	AFS 31, silver overall. Withdrawn 23-10-1985, scrapped 21-6-1993
716 Red	MiG-21F-13	740911	1-10-63	JG 3	JG 8, AFS-31, withdrawn 30-11-1978, SDHS Marxwalde, scrapped there 21-6-1993
718 Red	MiG-21F-13	742012	7-8-62	JG 8	JG 9, JG 3, withdrawn 1969 or 14-2-1972, preserved Army Museum Dresden
720 Red	MiG-21F-13	741604	1-6-64	JG 3	JG 9, JG 3, ground accident 27-7-1967, withdrawn 1969 or 2-1972, SDHS Trollenhagen and scrapped?
721 Red	MiG-21F-13	741605	1-10-63	JG 3	JG 9, crashed 1-10-1964
724 Red	MiG-21F-13	74212013	7-8-62	JG 8	JG 3, JG 9, JAG 15, damaged 15-1-1965 but subsequently repaired, withdrawn 30-11-1978, SDHS Preschen and then scrapped
726 Red	MiG-21F-13	741606	1-7-64	JG 3	JG 9, AFS 31, withdrawn 23-10-1985, SDHS Preschen, preserved Lehnin 1984
728 Red	MiG-21F-13	740915	1-10-63	JG 3	JG 8, JG 9, JG 15, withdrawn 30-11-1978, scrapped Trollenhagen 1988
732 Red	MiG-21F-13	N74212014	1-6-62	JG 8	JG 3, silver overall. Withdrawn 28-2-1974, to Dresden as test platform
734 Red	MiG-21F-13	740907	1-10-63	JG 3	JG 8, JG 9, AFS 31, JAG 15, silver overall. Withdrawn 30-11-1978, scrapped 7-1988
736 Red	MiG-21F-13	741607	1-7-64	JG 3	JG 9, AFS 31, withdrawn 23-11-1985, SDHS Preschen, preserved Lehnin 1994
737 Red	MiG-21F-13	741608	1-7-64	JG 3	JAG 15, AFS 31, silver overall, withdrawn 30-4-1980 and preserved at German Spaceflight Exhibition, Morgenröthe-Rautenkranz
741 Red	MiG-21F-13	741612	25-6-64	JG 3	JAG 15, dark green/dark earth camouflage. Damaged 1967, withdrawn 30-11-1978, SDHS Cottbus/Holzdorf, scrapped 20-4-1994
744 Red	MiG-21F-13	N74212006	1-6-62	JG 8	JG 9, JG 3, JAG 15, AFS 31, withdrawn 23-10-1985 and scrapped
745 Red	MiG-21F-13	N74211921	27-5-62	JG 8	JG 9, JAG 15, withdrawn 30-11-1978, SDHS Marxwalde as '555 Red', scrapped 20-5-1994 (some sources suggest 6-1993)
747 Red	MiG-21F-13	741614	25-6-64	JG 3	JAG 15, damaged 7-4-1970 withdrawn 30-11-1978 and scrapped
749 Red	MiG-21F-13	741616	25-6-64	JG 3	AFS 31, damaged 6-11-1969 withdrawn 23-10-1985, MTS Bad Düben, parts to Dresden Army Museum, scrapped 17-6-1993
759 Red	MiG-21F-13	741609	16-5-64	JG 3	AFS 31, damaged 28-8-1970, crashed 12-10-1977
797 Red	MiG-21F-13	741621	16-5-64	JG 3	Forced landing and written off 25-9-1969
790 Red	MiG-21F-13	N74211708	9-5-62	JG 8	JG 3, crashed 22-10-1966

MiG-21F-13 '639 Red', AFS 31, Preschen, 1985

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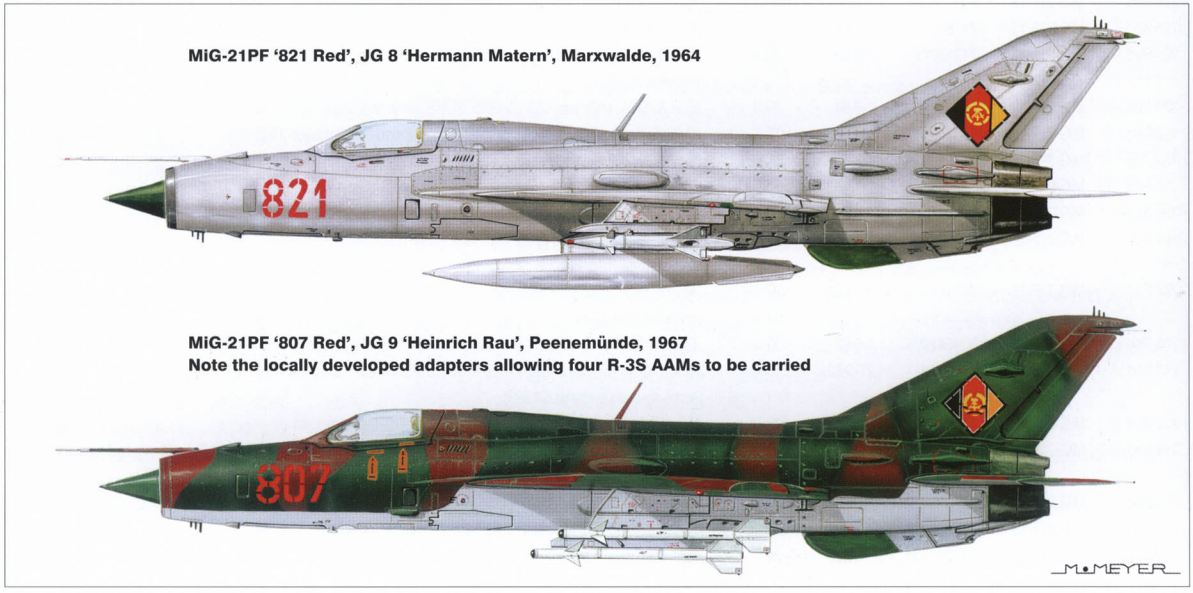
▲ **A flight of silver-painted MiG-21PFMs of JG 2 'Juri Gagarin' over the countryside of Mecklenburg-Vorpommern District in June 1977.**

Preschen converted to the type in October 1964. Later, JG 9 'Heinrich Rau' at Peenemünde also flew this variant and a few served with *Aufklärungsfliegerstaffel* 31 (Reconnaissance Air Squadron, AFS) at Preschen, which was redesignated TAFS 47 on 1st November 1986. This unit was formed after JG 7 'Wilhelm Pieck' at Drewitz was disbanded on 1st September 1989, its aircraft redeploying to JG 2 'Juri Gagarin' (again, *their* spelling), TAFS 47 and a second reconnaissance squadron, TAFS 87, at Drewitz.

When withdrawn from first-line duty, many EGAF MiG-21F-13s served with *Jagdfliegerausbildungsgeschwader* 15 'Heinz Kapelle' (Fighter Training Wing, JAG) at Rothenburg, which was subsequently redesignated FAG 15 (*Fliegerausbildungsgeschwader* – Flying Training Wing).

(A note on the persons after whom the abovementioned units received their honorary appellations. Hermann Matern was a participant of the German communist and anti-Nazi movement in the 1930s/1940s and later a



MiG-21PF '821 Red', JG 8 'Hermann Matern', Marxwalde, 1964

MiG-21PF '807 Red', JG 9 'Heinrich Rau', Peenemünde, 1967
Note the locally developed adapters allowing four R-3S AAMs to be carried

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◄
Another falsified serial. EGAF MiG-21PFM '1986 Red' (actually '986 Red' of JG 2) shares the flight line with a Polish Air Force MiG-21*bis* during a Warsaw Pact exercise in 1987.

An impressive row of at least 47 MiG-21PFMs of JG 2 at Trollenhagen AB. The camouflage pattern varies considerably on individual aircraft.
▼

prominent East German politician. Vladimir M. Komarov was a Soviet cosmonaut who lost his life on 24th April 1967 when his space capsule's heat shield failed during reentry. Heinrich Rau was another East German statesman; he headed the State Planning Council and was also Minister of Machinery Production and Minister of Foreign Trade. Wilhelm Pieck was President of the German Democratic Republic in the 1950s. Yuriy A. Gagarin was the first Soviet cosmonaut and the first-ever man in space. Heinz Kapelle was another participant of the German anti-Nazi resistance movement and head of the KJVD (*Kommunistischer Jugendverband Deutschlands* – German Communist Youth League); he was arrested and executed by the Nazis in 1941.)

Like the other EGAF single-seat fighters, the MiG-21s were given red three-digit serials, which were occasionally reused. For security reasons the EGAF often changed the serials on aircraft intended for public view (museum exhibits or publicity photos/films) – usually by obscuring or adding a digit or two. Aircraft with such 'doctored' serials are duly indicated in the fleet lists.

Abbreviations are used in the tables below for locations after withdrawal from service:

Aerotec is a company at Rothenburg where many ex-EGAF aircraft were sent for disposal after being stored after withdrawal. This maintenance organisation moved there from Saarbrücken and has developed a business converting military aircraft for civil use. It helped support the Luftfahrttechnischer Museumverein Rothenburg.

FWD – *Flugzeugwerft Dresden* (Dresden Aircraft Repair Plant; formerly *Flugzeugwerke Dresden* – Dresden Aircraft Factory No. 803. Now called EFW – Elbe Flugzeugwerft);

MTS – *Militärtechnische Schule* (Military Technical School) at Bad Düben;

OHS – *Offiziershochschule* (Officers' High School) at Kamenz;

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MiG-21PFM '751 Red', JG 7 'Wilhelm Pieck', Drewitz, 1966
751
MiG-21PFM '935 Red' upgraded to carry four R-60 AAMs on APU-60-2 launch rails; FAG 15, Rothenburg, 1990
935
M.MEYER

East German Air Force MiG-21PFs

Serial	Version	C/n	In-service	First unit	Comments
805 Red	MiG-21PF	760511	4-11-64	JG 8	Crashed 12-10-1965
807 Red	MiG-21PF	760512	4-11-64	JG 8	JG 9, crashed 7-4-1967
809 Red	MiG-21PF	760513	4-11-64	JG 8	JG 2, crashed 29-8-1986
812 Red	MiG-21PF	760514	4-11-64	JG 8	Silver overall, later dark green/dark earth camouflage. OHS Kamenz, withdrawn 1969 as training airframe without insignia, 1977 OHS Rothenburg where scrapped 19-5-1994
814 Red	MiG-21PF	760515	4-11-64	JG 8	JG 9, crashed 11-8-1967
816 Red	MiG-21PF	760602	4-11-64	JG 8	JG 2, Dresden 31-3-1989, withdrawn for Iran 30-11-1988 but scrapped Dresden 1991
818 Red	MiG-21PF	760603	4-11-64	JG 8	JG 2, crashed 25-3-1974
821 Red	MiG-21PF	760604	4-11-64	JG 8	JG 2, withdrawn 23-10-1986 to Peenemünde as SDHS. Preserved 17-7-1992 Peenemünde Museum as '992 Red'; later reverted to '821 Red' but in non-authentic tan/green camouflage
823 Red	MiG-21PF	760605	4-11-64	JG 8	JG 2, silver overall, Q-mark. Withdrawn 8-12-1987 as ground target Trollenhagen where scrapped 28-9-1994.
825 Red	MiG-21PF	760606	4-11-64	JG 8	JG 2, silver overall. Withdrawn 8-12-1987 for monument at Trollenhagen, currently preserved Neuhardenburg (former Marxwalde)
828 Red	MiG-21PF	760609	4-11-64	JG 8	JG 2, Dresden 1988 where withdrawn 30-11-1988 and earmarked for Iran but scrapped Dresden 1991
830 Red	MiG-21PF	760611	4-11-64	JG 8	JG 2, crashed 29-4-1969
832 Red	MiG-21PF	761001	1-5-65	JG 8	JG 2, withdrawn 26-10-1985, stored Trollenhagen, scrapped there 1988
835 Red	MiG-21PF	761002	24-4-65	JG 8	Crashed 25-6-1965
837 Red	MiG-21PF	761003	3-4-65	JG 8	Crashed 30-6-1965
840 Red	MiG-21PF	761004	1-5-65	JG 8	JG 9, JG 2, withdrawn 15-4-1973, training airframe MTS Bad Düben
843 Red	MiG-21PF	761005	1-5-65	JG 8	JG 9, JG 2, withdrawn 30-11-1988 and earmarked for Iran but scrapped Trollenhagen 1994
846 Red	MiG-21PF	761006	1-5-65	JG 8	JG 9, JG 2, dark green/dark earth camouflage. Withdrawn 5-7-1972, training airframe MTS Bad Düben, later scrapped?
848 Red (1)	MiG-21PF	761007	4-65	JG 8	JG 9, JG 2, crashed 2-10-1976 after bird strike; see MiG-21*bis* table
851 Red	MiG-21PF	761008	1-5-65	JG 8	JG 9, JG 2, silver overall, Q-mark; later dark green/dark earth camouflage; disguised as '1851 Red' at one time for publicity filming. Dresden 1988; withdrawn 30-8-1988 and earmarked for Iran but scrapped Dresden 30-8-1988
854 Red	MiG-21PF	761009	12-4-65	JG 8	JG 9, JG 2, withdrawn 30-11-1987, stored Dresden 1988, then used for chemical warfare excercises Storkow, scrapped 31-3-1994

858 Red	MiG-21PF	761010	1-5-65	JG 8	JG 1, JG 9, JG 2, Dresden 1988 where withdrawn 30-11-1988 and earmarked for Iran but scrapped Dresden 1991
860 Red	MiG-21PF	761011	29-4-65	JG 8	Crashed 5-9-1966
862 Red	MiG-21PF	760811	1-5-65	JG 8	JG 9, JG 2, withdrawn 26-3-1986, Dresden for trials, scrapped there 10-1990
864 Red	MiG-21PF	760913	1-5-65	JG 8	JG 9, JG 2, withdrawn 30-11-1987, chemical warfare excercises Storkow 1988, scrapped 31-3-1994
868 Red	MiG-21PF	761103	29-4-65	JG 8	Silver overall, later dark green/dark earth camouflage. Withdrawn 30-11-1987, preserved Army Museum, Dresden
870 Red	MiG-21PF	760914	1-5-65	JG 8	Dresden 1988, withdrawn 30-11-1988 and earmarked for Iran; not delivered but preserved 1990 Rimini, Italy, in fake Islamic Republic of Iran AF '3-0914'
874 Red	MiG-21PF	760915	9-4-65	JG 8	JG 9, crashed 14-10-1966
877 Red	MiG-21PF	761012	1-4-65	JG 1	JG 9, JG 2, silver overall. Withdrawn 30-11-1987, gate guard Holzdorf as '1982 Red', later as Luftwaffe '23+82'
881 Red	MiG-21PF	761104	15-6-65	JG 1	Crashed 5-5-1966 in Poland
883 Red	MiG-21PF	761105	1-4-65	JG 1	JG 9, JG 2, silver overall, Q-mark. Dresden 1988, withdrawn 30-11-1988 and earmarked for Iran but scrapped Dresden 1990
885 Red	MiG-21PF	761106	1-4-65	JG 1	JG 9, JG 2, Dresden 1988, withdrawn 30-8-1988 and earmarked for Iran 30-11-1988 but stored Trollenhagen and scrapped there 28-9-1994
887 Red	MiG-21PF	761107	15-5-65	JG 1	JG 2, destroyed on the ground 11-10-1974 (or 11-4-1974) after 990 caught fire and exploded
890 Red	MiG-21PF	761108	19-7-65	JG 1	JG 9, JG 2, silver overall, Q-mark. Dresden 1988, withdrawn 30-11-1988 and earmarked for Iran but stored Trollenhagen 28-9-1994, reported sold 4-1996 in Rochester, MN, USA, registered as N6285D 20-1-2000, other sources state scrapped 28-9-1994
893 Red	MiG-21PF	761109	15-5-65	JG 1	JG 9, JG 2, withdrawn 13-2-1973 after fire when on ground, reported scrapped 28-2-1974 but also reported sold to the USA 4-1996 and registered later as N6285L
896 Red	MiG-21PF	761110	15-5-65	JG 1	JG 2, silver overall. Dresden 1988, withdrawn 30-11-1988 (or 30-11-1987) for Iran but noted as monument in Trollenburg, scrapped 28-9-1994, possibly in Marxwalde
899 Red	MiG-21PF	761111	15-5-65	JG 1	JG 9 or JG 3, JG 2, withdrawn 10-5-1973 after accident 1-10-71 at the pressurised refuelling tank, scrapped 30-5-1973
901 Red	MiG-21PF	761112	15-5-65	JG 1	JG 9, JG 2, withdrawn 30-11-1987, in 1988 chemical exercises Storkow, scrapped 31-3-1994
908 Red	MiG-21PF	761113	15-5-65	JG 1	JG 8, JG 9, JG 2, dark green/dark earth camouflage; disguised as '1908 Red' at one time for publicity filming. Dresden 1988, withdrawn 30-11-1988 for Iran, but scrapped Marxwalde 28-9-1994
913 Red	MiG-21PF	761114	15-5-65	JG 1	JG 9, JG 2, crashed 4-8-1968
918 Red	MiG-21PF	761115	15-5-65	JG 1	JG 9, JG 2, withdrawn 30-11-1987, scrapped 13-6-1994 Drewitz
920 Red	MiG-21PF	761201	17-5-65	JG 1	JG 9, destroyed on the ground together with 887 by explosion caused by fire 11-10-1974 (or 11-4-1974)
922 Red	MiG-21PF	761202	17-5-65	JG 1	JG 2, crashed 27-4-1971
928 Red	MiG-21PF	761203	17-5-65	JG 2	JG 9, JG 2, crashed 15-6-1972 after collision with a Soviet Su-7B of the 19th GvAPIB
931 Red	MiG-21PF	761204	28-2-65	JG 1	JG 9, JG 2, crashed 5-2-1970
934 Red	MiG-21PF	761205	28-2-65	JG 1	JG 9, JG 2, withdrawn 23-10-1986, ground target at Peenemünde range, later preserved Peenemünde Museum
936 Red (1)	MiG-21PF	761207	17-5-65	JG 1	JG 9, JG 2, withdrawn 20-3-1972 when caught fire after forced landing through bird strike; see MiG-21*bis* table
939 Red	MiG-21PF	761208	17-5-65	JG 1	JG 9, JG 2, silver overall. Crashed 6-5-1988 after bird strike
942 Red	MiG-21PF	761209	17-5-65	JG 1	JG 9, JG 2, withdrawn 30-11-1987 or 30-6-1988, scrapped 1988 Trollenhagen, front fuselage to Army Museum, Dresden
944 Red	MiG-21PF	761210	17-5-65	JG 1	JG 9, JG 2, silver overall, later dark green/dark earth camouflage. Withdrawn 1-8-1987
947 Red	MiG-21PF	761211	17-5-65	JG 1	JG 9, JG 2, silver overall, later dark green/dark earth camouflage, Q-mark. Dresden 1988, withdrawn 30-11-1988 and earmarked for Iran, but became ground target at Tollenhagen, scrapped 28-9-1994
950 Red (1)	MiG-21PF	761402	1-5-65	JG 1	JG 9, JG 2, dark green/dark earth camouflage. Withdrawn 10-5-1973, training airframe, 30-5-1973 MTS Bad Düben as cutaway instructional airframe, then to TSLw 3 Fassberg, later preserved Luftwaffe Museum; see MiG-21*bis* table

SDHS – *Schein-DHS* ('mock DHS', that is, *Diensthabendes System*; DHS was EGAF slang for aircraft in active service), a term for non-airworthy aircraft parked as decoys near the ends of runways;

TSLw – *Technische Schule der Luftwaffe* (Technical School of the Luftwaffe);

WTD – *Wehrtechnische Dienstelle* (literally Weapon Technical Service, that is, weapons/hardware testing establishment).

'Q-mark' indicates that the aircraft sported the 'winged Q' (for *Qualität*) maintenance award badge used in the EGAF as an incentive for keeping the aircraft in excellent condition. This mark had several grades and could be revoked if the aircraft was not maintained well enough afterwards.

A total of 76 MiG-21F-13s was delivered; initial deliveries were Gor'kiy-built examples, but the machines delivered from 1963 onwards

East German Air Force/Luftwaffe MiG-21PFMs (cannon-less – 'MiG-21SPS')

EGAF serial	Version (OKB designation)	C/n	In-service date	First unit	Luftwaffe serial	Comments
698 Red	MiG-21PFM	944503	1-11-66	JG 8?		Withdrawn 31-12-1969, training airframe OHS Kamenz, then Diepensee, now preserved Hatten, France as 'EGAF 869 Red'
703 Red	MiG-21PFM	944006	15-4-66	JG 8	22+22	JG 3, JG 7, JAG-15, withdrawn 10-1990, stored Rothenburg, 2000 preserved Wernigerode
704 Red	MiG-21PFM	944007	8-9-66	JG 8		JG 1, silver overall; disguised as '17043 Red' at one time for publicity filming. Crashed 8-1-1981.
706 Red	MiG-21PFM	944008	15-4-66	JG 8		JG 3, JG 2, destroyed 1-9-1980 after collision with MiG-21PFM '984 Red' when landing at Warbelow tactical strip
709 Red	MiG-21PFM	944009	1-9-66	JG 8		JG 3, JAG 15, JG 7, dark green/dark earth camouflage. Withdrawn 3-1-1989, later scrapped
711 Red (1)	MiG-21PFM	944208	1-12-66	JG 8		JG 1, JG 2, JG 7, crash-landed 13-9-1989, later scrapped in Dresden. See MiG-21PFM c/n 946703 in next table
717 Red	MiG-21PFM	944209	1-9-66	JG 8	22+23	JG 3, JG 1, JAG 15, withdrawn 10-1990, stored Rothenburg, 21-11-1994 preserved Ankum Museum
719 Red	MiG-21PFM	944210	8-9-66	JG 8		Crashed 3-5-1968
722 Red	MiG-21PFM	944211	1-9-66	JG 8		JG 1, JG 7, silver overall. Withdrawn 18-9-1989 and scrapped
725 Red	MiG-21PFM	944212	1-9-66	JG 8		JG 1, dark green/dark earth camouflage. Withdrawn 1-12-1976, training airframe MTS Bad Düben, 27-1-1993 Dessau Museum, 2000 preserved Merseburg
729 Red	MiG-21PFM	944213	8-7-66	JG 8	22+24*	JG 3, JAG 15, withdrawn 10-1990, stored Rothenburg, preserved 2 4-11-1994 War Eagles Museum, England; later sold to Santa Teresa Museum, NM, USA, as 22+24 but with EGAF insignia on tail!
730 Red	MiG-21PFM	944214	30-6-66	JG 8		JG 7, JAG 15, silver overall. Crashed 8-5-1980
733 Red	MiG-21PFM	944215	30-6-66	JG 8		JG 3, JAG 15, JG 7, withdrawn 30-11-1989 and scrapped
738 Red	MiG-21PFM	944301	12-7-66	JG 8	22+25	JG 9, JG 1, JAG 15, withdrawn 10-1990, stored Rothenburg, 28-8-1993 Auto & Technik Museum Sinsheim, now preserved Technik Museum Speyer as 'Indian Air Force C993' in silver/pink colours
740 Red	MiG-21PFM	944302	13-7-66	JG 8	22+26	JG 3, JG 7, JAG 15, withdrawn 10-1990, stored Rothenburg, 7-4-1994 preserved Museo del Aire, Madrid-Cuatro Vientos, Spain
742 Red	MiG-21PFM	944303	22-7-66	JG 8	22+27	JG 3, JG 7, withdrawn 10-1990, stored Rothenburg, 15-2-1994 Aerotec, later exhibited supermarket Zwickau, now preserved Nöbitz
750 Red	MiG-21PFM	944304	11-7-66	JG 3?		JG 7, JG 1, JG 2, JG 7, withdrawn 13-10-1989 and scrapped
751 Red	MiG-21PFM	944305	11-7-66	JG 8		JG 7, JAG 15, JG 7, withdrawn 3-10-1989 and scrapped
755 Red	MiG-21PFM	944306	23-9-66	JG 8		JG 1, crashed 18-5-1968
756 Red	MiG-21PFM	944307	23-9-66	JG 8		JG 1, JG 7, JAG 15, JG 7, silver overall; disguised as '17568 Red' at one time for publicity filming. Withdrawn 3-10-1989, chemical warfare exercises Waldsieversdorf, illegally at 'Alternatives Kunstlerhaus Tachales', Berlin 1993
758 Red	MiG-21PFM	944308	23-9-66	JG 8		JG 3, JG 1, JG 7, silver overall, Q-mark. Withdrawn 18-9-1989 and scrapped, some components later noted Sammlung Hübner at Grossröhrsdorf
760 Red	MiG-21PFM	944309	25-7-66	JG 8	22+28	JG 9, JG 3, JG 1, FAG 15, withdrawn 10-1990, stored Rothenburg; preserved Motortechnica Museum, Bad Oeyenhausen, 24-11-1994, later to Ankum Museum
762 Red	MiG-21PFM	944606	23-9-66	JG 8		JG 1, JG 3, JG 1, JG2, JG 7, silver overall. Withdrawn 3-10-1989, noted at a museum in El Paso, TX, USA
763 Red	MiG-21PFM	944313	23-9-66	JG 8		JG 3, JG 1, JG 2, JG 7, withdrawn 14-8-1989, used for chemical warfare exercises Waldsieversdorf, later illegally at 'Alternatives Kunstlerhaus Tachales', Berlin 1993
764 Red	MiG-21PFM	944314	1-11-66	JG 8		JG 7, JAG 15, JG 7, withdrawn 3-10-1989, dismantled at Dresden Armeemuseum, fuselage later at Aviation Museum Köln; nose reportedly at Wycombe Air Park, England
765 Red	MiG-21PFM	944505	1-11-66	JG 8		JG 7, JAG 15, JG 2, JG 7, withdrawn 2-10-1989 and scrapped
766 Red	MiG-21PFM	944506	6-9-66	JG 8		JG 3, silver overall. 1980 renumbered 833 Red cf
767 Red	MiG-21PFM	944507	1-11-66	JG 8		JG 7, written off after crash landing 2-8-1971, noted as OHS training airframe 30-3-1972, preserved 5-7-1994 Seifertshofen (noted 3-2002)
768 Red	MiG-21PFM	944607	1-11-66	JG 8		JG 3, JG 1, JG 7, dark green/dark earth camouflage. Withdrawn 13-9-1989 and scrapped
770 Red	MiG-21PFM	944509	30-8-66	JG 8		JG 3, JG 1, JG2, JG 7, withdrawn 30-11-1989, training airframe MTS Bad Düben, 20-10-1993 preserved 20-10-1993 Toulouse
771 Red	MiG-21PFM	944510	8-9-66	JG 8	22+29	JG 1, JG 2, JAG 15, withdrawn 10-1990, stored Rothenburg, 17-8-1994 preserved Museum Sömmerda, later Erfurt-Bindersleben airport (noted 5-2001)

778 Red	MiG-21PFM	944501	1-11-66	JG 8		JG 1, JG 3, JG 15, crashed 30-12-1983
779 Red	MiG-21PFM	944502	19-8-66	JG 8		JG 7, withdrawn 1-4-1969, OHS training airframe Kamenz then Bad Düben, 27-7-95 preserved Luftwaffe Museum, later on loan to Merseburg
780 Red	MiG-21PFM	944310	2-8-66	JG 8	22+30	JG 3, JAG 15, JG 2, FAG 15, withdrawn 10-1990, stored Rothenburg, preserved FWD 29-9-1994, then at Grossenhain as '780 Red'
783 Red	MiG-21PFM	944504	6-9-66	JG 8	22+31	JG 3, JG 1, FAG 15. Withdrawn 10-1990, stored Rothenburg, 8-8-1995 to Aerotec
787 Red	MiG-21PFM	944610	1-11-66	JG 8		JG 3, JG 2, JG 7, dark green/dark earth camouflage. Withdrawn 30-11-1989 and scrapped
789 Red	MiG-21PFM	944612	25-9-66	JG 8		JG 3, JG 7, crashed 10-5-1973
791 Red	MiG-21PFM	944613	25-9-66	JG 8		JG 3, JG 7, dark green/dark earth camouflage, Q-mark. Withdrawn 3-10-1989, stored Kamenz, training airframe OHS, 1-8-1995 to Nordholz Museum
793 Red	MiG-21PFM	944611	1-2-67	JG 8		JG 1, JAG 15, JG 7, withdrawn 30-11-1989 and scrapped
795 Red	MiG-21PFM	944614	1-2-67	JG 8		JG 1 JG 3, JG 1, JG 7, dark green/dark earth camouflage. Withdrawn 18-9-1989 and scrapped
796 Red	MiG-21PFM	944615	1-2-67	JG 8		JG 3, JAG 15, JG 7, withdrawn 30-11-1989 and scrapped
798 Red	MiG-21PFM	944701	6-10-66	JG 8		JG 1, JG 3, JG 1, silver overall. Crashed 1-9-1981.
808 Red	MiG-21PFM	944702	5-10-66	JG 8		JG 1, crashed 26-6-1973
813 Red	MiG-21PFM	944703	1-1-66	JG 8		JG 7, JAG 15, JG 7, silver overall. Withdrawn 3-10-1989 and scrapped
819 Red	MiG-21PFM	944704	1-10-66	JG 8		JG 3, JG 1, JG 7, dark green/dark earth camouflage. Withdrawn 31-8-1989, chemical warfare exercises Storkow, scrapped 31-3-1994
829 Red	MiG-21PFM	944705	1-10-66	JG 8		JG 7, JG 15, dark green/dark earth camouflage. Withdrawn 25-6-1979, gate guard Bautzen, preserved 11-10-1991 Aviation Museum Köln, 2001 Bonn-Hangelaar, from 8-2002 Merseburg, no insignia
833 Red	MiG-21PFM	944506	6-9-66	JG 3	22+32	Ex-766 Red, renumbered 1980, FAG 15 1882, withdrawn 10-1990, stored Rothenburg, 8-3-1995 preserved Bad Ischl, Austria
836 Red	MiG-21PFM	944706	1-10-66	JG 8		JG 7, JG 3, JG 2, JG 7, dark green/dark earth camouflage. Damaged 3-1-1977, withdrawn 31-1-1989 and dismantled, front fuselage to Hübner at Grossröhrsdorf, now at Finow
838 Red	MiG-21PFM	944508	12-2-67	JG 8		Crashed 7-8-1967,
841 Red	MiG-21PFM	945113	1-3-67	JG 8		JG 9, JG 2, silver overall, later dark green/dark earth camouflage. Withdrawn 14-8-1989 and scrapped
847 Red	MiG-21PFM	945114	1-3-67	JG 8		JAG 15, JG 7, withdrawn 30-11-1989 and scrapped
849 Red	MiG-21PFM	945115	6-1-67	JG 1		Crashed Cottbus town 14-1-1975
852 Red	MiG-21PFM	945201	1-3-67	JG 8		JG 3, FAG 15, withdrawn 9-9-1989 after crash landing and scrapped 18-9-1989
861 Red	MiG-21PFM	945202	17-1-67	JG 1	22+33	FAG 15, JG 7, dark green/dark earth camouflage. Withdrawn 10-1990, 23-8-1993 preserved Auto & Technik Museum Sinsheim as '22 33' without insignia
865 Red	MiG-21PFM	945203	1-3-67	JG 1		JG 7, withdrawn 18-9-1989, chemical warfare exercises Storkow, scrapped 31-3-1994
869 Red	MiG-21PFM	945204	17-1-67	JG 1	22+34	JG 2, FAG 15, withdrawn 10-1990, stored Rothenburg, 15-8-1994 preserved Seifertshofen
871 Red	MiG-21PFM	945205	24-2-67	JG 1		Crashed 16-5-1969
878 Red	MiG-21PFM	945206	17-1-67	JG 1	22+35	FAG 15, withdrawn 10-1990, stored Rothenburg, sold 15-4-1994 to P. Heinrich of Süpplingenburg, 1999 preserved Fanifly Restaurant, Harbke
882 Red (1)	MiG-21PFM	945207	16-1-67	JG 1		Crash landing 25-6-1968, withdrawn 26-6-1979, MTS Kamenz, then MTS Bad Düben as training airframe, 21-6-1995 preserved Nancy, France, later at Albert. See MiG-21MF table
884 Red	MiG-21PFM	945208	1-3-67	JG 1		JAG 15, JG 7, withdrawn 3-10-1989 and scrapped
889 Red	MiG-21PFM	945209	19-1-67	JG 1	22+36	JG 3, FAG 15, withdrawn 10-1990, stored Rothenburg, 22-10-1993 preserved Hermeskeil
891 Red	MiG-21PFM	945210	19-1-67	JG 1	22+37	JG 3, FAG 15, silver overall, Q-mark. Withdrawn 10-1990, stored Rothenburg, 9-7-1994 preserved Dessau Museum, 1998 moved to Bodø, Norway
894 Red	MiG-21PFM	945211	1-3-67	JG 1		JG 3, JAG 15, JG 7, withdrawn 30-11-1989 and scrapped
897 Red	MiG-21PFM	945509	17-3-67	JG 1	22+38	JG 3, JAG 15, JG 2, FAG 15, two-tone green camouflage. Withdrawn 10-1990, stored Rothenburg, 20-12-1994 preserved Finow as '22 38' without insignia
898 Red	MiG-21PFM	945510	21-3-67	JG 1	22+39	FAG 15, withdrawn 10-1990, stored Rothenburg, 28-2-1994 preserved Overloon, Holland
919 Red	MiG-21PFM	945511	23-3-67	JG 1	22+40	JG 3, JAG 15, withdrawn 10-1990, stored Rothenburg; 26-8-1993 preserved Motortechnica Museum, Bad Oeyenhausen, then moved 1996 to Soesterberg, Holland as 'EGAF 804 Red'
924 Red	MiG-21PFM	945512	30-5-67	JG 1		Crashed 21-9-1967
929 Red	MiG-21PFM	945513	30-5-67	JG 1		JG 3, JAG 15, JG 7, damaged in collision with An-2 '456 Black', repaired, withdrawn 15-10-1989 and scrapped
932 Red	MiG-21PFM	945514	30-5-67	JG 1		Crashed 7-12-1967
933 Red	MiG-21PFM	945515	15-6-67	JG 1		Silver overall. Crashed in Poland 29-1-1976
935 Red	MiG-21PFM	945601	15-6-67	JG 1		JAG 15, crashed Lodenau 8-3-1990
937 Red	MiG-21PFM	945602	6-4-67	JG 1	22+41	JAG 15, withdrawn 10-1990, stored in Rothenburg, to Aerotec 15-12-1994 but sold 6-1998
938 Red	MiG-21PFM	945603	15-6-67	JG 1		JG 3, FAG 15, JG 7, dark green/dark earth camouflage. Withdrawn 3-10-1989 and scrapped

940 Red	MiG-21PFM	945604	6-4-67	JG 1	22+42	JAG-15, withdrawn 10-1990, stored Rothenburg, 26-8-1993 to Aerotec, noted 2006 preserved in a front garden in Giessen
943 Red	MiG-21PFM	945605	1-6-67	JG 1		JG 3, JAG 15, JG 2, JG 7, dark green/dark earth camouflage. Withdrawn 6-5-1988 and scrapped
948 Red	MiG-21PFM	945606	6-4-67	JG 1	22+43	JG 2, FAG 15, withdrawn 10-1990, stored Rothenburg, 30-6-1994 preserved Baschütz, Bautzen, reported 2006 at Firma Kleber, Neugersdorf
949 Red	MiG-21PFM	945607	1-6-67	JG 1		JG 9, JG 1, JG 2, JG 7, dark green/dark earth camouflage. Withdrawn 31-8-1989, training airframe MTS Bad Düben 25-1-1990, scrapped 6-1993
952 Red	MiG-21PFM	946407	1-2-68	JG 1		JG 3, JAG 15, JG 7, withdrawn 30-11-1989 and scrapped
953 Red	MiG-21PFM	946408	8-12-67	JG 9	22+44	JG 1, JG 2, FAG 15, silver overall, Q-mark and '1000' titles to mark 1,000 flight hours. Withdrawn 10-1990, stored Rothenburg, 10-1-1994 preserved Bad Oeynhausen as Soviet Air Force '353'
958 Red	MiG-21PFM	946409	1-3-68	JG 1		JG 3, JG 1, JG 2, JG 7, silver overall, later dark green/dark earth camouflage. Withdrawn 2-10-1989 and scrapped
963 Red	MiG-21PFM	946410	1-3-68	JG 1	22+45	JG 2, FAG 15, withdrawn 10-1990, stored Rothenburg, preserved 18-7-1994 Seifertshofen, later Baarlo, Holland
964 Red	MiG-21PFM	946411	1-3-68	JG 1		JG 3, JAG 15, JG 7, withdrawn 30-11-1989 and scrapped
965 Red	MiG-21PFM	946412	23-3-68	JG 1		JG 3, JAG 15, JG 7, forced landing 5-9-1972, repaired, withdrawn 30-11-1989 and scrapped

*Official OKB-MiG designations are used in the table, not the local designation MiG-21SPS.

East German Air Force/Luftwaffe MiG-21PFMs (cannon-armed – 'MiG-21SPS-K')

EGAF serial	Version	C/n	In-service date	First unit	Luftwaffe serial	Comments
404 Red	MiG-21PFM	946702	25-1-68	JG 9	22+08	JG 8, JG 3, JG 2, silver overall, Q-mark (later revoked). Withdrawn 10-1990, stored Trollenhagen, scrapped 28-9-1994
429 Red	MiG-21PFM	946703	24-1-68	JG 9	22+01	JG 8, JG 1, renumbered 711 Red in 1989 cf
431 Red (1)	MiG-21PFM	946706	29-3-68	JG 3		JG 9, crashed 1-8-1973; see MiG-21M table
432 Red	MiG-21PFM	946707	29-3-68	JG 9		Destroyed Peenemünde 29-1-1969
436 Red	MiG-21PFM	946708	1-4-68	JG 8		JG 1, JG 2, JG 7, withdrawn 2-10-1989 and scrapped
441 Red	MiG-21PFM	946709	30-1-68	JG 8	22+02*	JG 3, JG 1, withdrawn 10-1990, stored Drewitz and painted in 'White Shark' farewell colours, scrapped 13-11-1992
443 Red	MiG-21PFM	946710	1-4-68	JG 3		JG 2, JG 7, dark green/dark earth camouflage. Withdrawn 30-11-1989 and scrapped
446 Red	MiG-21PFM	946711	1-2-68	JG 8		JG 1, silver overall. Crashed North Berlin 23-3-1978
449 Red	MiG-21PFM	946712	10-4-68	JG 8		JG 1, JG 7, dark green/dark earth camouflage. Withdrawn 18-9-1989, training airframe OHS, exhibited Drewitz, preserved 11-1999 Cottbus, currently Cämmerswalde
462 Red	MiG-21PFM	946807	1-4-68	JG 8		JG 2, JG 7, silver overall, later dark green/dark earth camouflage. Withdrawn 31-8-1989 and scrapped
463 Red	MiG-21PFM	946808	20-2-68	JG 3	22+20	JG 8, JG 1, JG 2, FAG 15, silver overall, later dark green/dark earth camouflage. Forced landing 17-4-1970 repaired, withdrawn 10-1990, stored Rothenburg, 20-8-1993 to Aerotec, 2000 displayed at Guttenburg Castle (noted 4-2001)
465 Red	MiG-21PFM	946802	10-4-68	JG 8		Withdrawn 15-8-1973 after heavy landing used as fire training airframe, wreck finally to JAG-15 as teaching aid, scrapped 1977
466 Red	MiG-21PFM	947003	13-3-68	JG 8	22+03	JG 3, JG 1, stored Drewitz, scrapped Dresden 17-11-1992
469 Red	MiG-21PFM	947004	5-5-68	JG 8		Crashed 28-7-1977
472 Red	MiG-21PFM	947005	12-3-68	JG 8		JG 1, dark green/dark earth camouflage. Withdrawn 13-5-1988 and dismantled, parts used to build training aid at OHS Kamenz, front fuselage preserved at the Luftwaffe Museum
473 Red	MiG-21PFM	947006	1-4-68	JG 8		Withdrawn 21-9-1971 after accident, training airframe 30-3-1972 MTS Bad Düben, 13-4-1994 preserved Soesterberg as USSR '47', later Lelystad as EGAF 473 Red
474 Red	MiG-21PFM	947007	1-4-68	JG 8		JAG 15, JG 1, JG 2, JG 7, silver overall. Withdrawn 13-9-1989, earmarked for Iraqi AF (Dresden job number 8711) but scrapped Dresden about 1991
476 Red	MiG-21PFM	947008	1-4-68	JG 8		JG 1, JG 2, JG 7, withdrawn 2-10-1989 and scrapped
479 Red	MiG-21PFM	947009	14-3-68	JG 3	22+09	JG 1, JG 2, two-tone green camouflage, Q-mark. Withdrawn 10-1990, preserved 1-2-1992 TSLw 3 Fassberg, 2001 to the Luftwaffe Museum as 479 Red without insignia

481 Red	MiG-21PFM	947010	14-3-68	JG 1	22+10	Damaged in ground collision 27-7-1984, JG 2, withdrawn 10-1990, stored Trollenhagen and scrapped 28-9-1994
484 Red	MiG-21PFM	947210	1-4-68	JG 1	22+04*	Dark green/dark earth camouflage. Withdrawn 10-1990, stored Drewitz, scrapped Dresden 17-3-1993
486 Red	MiG-21PFM	947211	1-4-68	JG 1	22+11	JG 1, JG 2, dark green/dark earth camouflage; disguised as '4861 Red' at one time for publicity filming. Withdrawn 10-1990, stored Trollenhagen, scrapped 28-9-1994
487 Red	MiG-21PFM	947212	4-68	JG 1		Silver overall. Crashed Cottbus 14-11-1974
489 Red	MiG-21PFM	947213	11-4-68	JG 1	22+05*	Dark green/dark earth camouflage. Withdrawn 10-1990, stored Drewitz, scrapped Dresden 8-11-1993
492 Red	MiG-21PFM	947214	1-5-68	JG 1	22+12	JG 1, JG 2, withdrawn 10-1990, stored Trollenhagen, scrapped 28-9-1994
542 Red	MiG-21PFM	947301	19-4-68	JG 1		Former 549 Red; renumbered again as 674 Red cf
545 Red	MiG-21PFM	947215	24-4-68	JG 1	22+21	JG 2, FAG 15, silver overall, later two-tone green camouflage, Q-mark. Withdrawn 10-1990, stored Rothenburg, 26-8-1993 Aerotec, preserved 2001 Rothenburg Museum as EGAF '545 Red'
549 Red	MiG-21PFM	947301	19-4-68	JG 1		Renumbered 542 Red in 1973 and later 674 Red cf
559 Red	MiG-21PFM	947302	18-4-68	JG 1		Renumbered 567 Red in 1977 cf
560 Red (1)	MiG-21PFM	947303	22-4-68	JG 1	22+06	Silver overall. Withdrawn 10-1990, stored Drewitz, then scrapped Dresden 26-4-1993. See also MiG-21MF table
565 Red	MiG-21PFM	947304	23-4-68	JG 1	22+13	JG 1, JG 2, withdrawn 10-1990, stored Trollenhagen, scrapped 28-9-1994
567 Red	MiG-21PFM	947302	18-4-68	JG 1		Former 559 Red, renumbered in 1970; crashed 17-1-1978
572 Red	MiG-21PFM	947305	24-4-68	JG 2	22+07	JG 1, JG 2, silver overall. Withdrawn 10-1990, stored Drewitz, scrapped Dresden 8-11-1993, cockpit to Savannah, GA, USA
674 Red	MiG-21PFM	947301	19-4-68	JG 1		Former 542 Red (and before that 549 Red), JG 8, JG 1, crashed 25-4-1984
711 Red (2)	MiG-21PFM	946703	24-1-68	JG 1		Former 429 Red, renumbered 1989, JG 7, dark green/dark earth camouflage. Withdrawn 10-1990, scrapped Dresden 7-10-1993. See MiG-21PFM c/n 944208 in previous table
959 Red	MiG-21PFM	946503	1-3-68	JG 9		JG 1, JG 2, dark green/dark earth camouflage. Withdrawn 14-8-1989, training airframe OHS Kamenz, 23-11-1994 to Imperial War Museum, Duxford; later to Coventry
966 Red	MiG-21PFM	946413	9-12-67	JG 3		JG 2, withdrawn 6-6-1972 after forced landing and scrapped, fuselage used as training airframe at OHS
967 Red	MiG-21PFM	946414	9-12-67	JG 3	22+14	JG 9, JG 2, silver overall. Withdrawn 10-1990, stored Trollenhagen and scrapped there 28-9-1994
968 Red	MiG-21PFM	946415	1-3-68	JG 9		JG 2, JG 7, dark green/dark earth camouflage. Withdrawn 3-10-1989 and scrapped.
969 Red	MiG-21PFM	946501	20-12-67	JG 9		JG 2, JG 1, JG 2, JG 7, dark green/dark earth camouflage. Withdrawn 31-8-89 for preservation at Bautzen Museum, 2-1990 to Uetersen, 24-2-1995 Ankum Museum
970 Red	MiG-21PFM	946502	9-12-67	JG 9		Crashed 10-2-1973
972 Red	MiG-21PFM	946504	9-3-68	JG 9		Crashed 20-7-1968
979 Red	MiG-21PFM	946505	1-3-68	JG 9		JG 1, JG 2, JG 7, silver overall. Withdrawn 17-11-1989, stored Dresden, scrapped there 1991 but front fuselage preserved at Hermeskeil
980 Red	MiG-21PFM	946506	27-12-67	JG 3	22+15	JG 2, withdrawn 10-1990, stored Trollenhagen, 4-5-1993 to WTD 52 and believed still extant
981 Red	MiG-21PFM	946704	29-3-68	JG 9		JG 3, JG 2, JG 7, dark green/dark earth camouflage. Withdrawn 13-9-1989, stored Drewitz, preserved 1990 Cottbus Museum
982 Red	MiG-21PFM	946705	28-1-68	JG 9	22+16	JG 3, JG 2, withdrawn 10-1990, stored Trollenhagen and scrapped 28-9-1994
983 Red	MiG-21PFM	946713	1-2-68	JG 9	22+17	JG 3, JG 2, dark green/dark earth camouflage. Withdrawn 10-1990, stored Trollenhagen and scrapped 28-9-1994
984 Red	MiG-21PFM	946714	5-2-68	JG 3		JG 2, destroyed after collision with MiG-21PFM '706 Red' at Warbelow tactical strip
986 Red	MiG-21PFM	946715	1-2-68	JG 9		JG 2, JG 7, dark green/dark earth camouflage; disguised as '1986 Red' at one time for publicity filming. Withdrawn 2-10-1989 as a gate guard Cottbus, preserved Cottbus Museum 25-2-1994, noted 2007 Kamenz
987 Red	MiG-21PFM	946801	1-2-68	JG 9		JG 1, JG 2, JG 7, withdrawn 31-8-1989, training airframe MTS Bad Düben, scrapped 17-6-1993
988 Red	MiG-21PFM	946803	8-2-68	JG 3	22+18	JG 2, dark green/dark earth camouflage. Withdrawn 10-1990, stored Trollenhagen and scrapped 28-9-1994
989 Red	MiG-21PFM	946804	9-2-68	JG 9	22+19	JG 8, JG 1, JG 2, withdrawn 10-1990, stored Trollenhagen, scrapped 28-9-1994, cockpit is in the Luftwaffe Museum
990 Red	MiG-21PFM	946805	29-3-68	JG 9		Crashed 16-12-1968
992 Red	MiG-21PFM	946806	1-3-68	JG 3		JG 2, JG 7, dark green/dark earth camouflage. Withdrawn 31-8-1989 and scrapped but photoproof exists as MiG-21PF and preserved in a city park!
998 Red	MiG-21PFM	946809	29-3-68	JG 9		Crashed and written off 14-5-1973, remains used for training, still extant 5-5-1990 but later scrapped
999 Red	MiG-21PFM	946810	21-2-68	JG 9		JG 2, silver overall. Crashed Neubrandenburg 27-4-1982

MiG-21MF '687 Red' operated by JG 3 shows the two-tone green camouflage scheme worn by some EGAF MiG-21s.

were Moscow-built. The last survivors were not withdrawn from service until 1985.

The last MiG-21F-13 for the EGAF arrived in June 1964 and very shortly afterwards in November of the same year, the initial consignment of its replacement, the MiG-21PF (*izdeliye* 76), was delivered. Lacking any cannon armament (the lessons of the Vietnam War had yet to be learnt), the new variant did, however, have radar and a longer range. There seems to have been some confusion with the designation. As far as the OKB and the Soviet Air Force were concerned it was MiG-21PF as stated above but the EGAF stubbornly called them MiG-21PFM. The explanation given was that the MiG-21PFs delivered in 1965 emanated from a later production series which differed from earlier deliveries by having improved radar protection against ground clutter and to mark this difference an 'M' for 'modified' was added by the EGAF to its designation.

MiG-21MF '685 Red' (another JG 3 aircraft) takes off with the help of SPRD-99 JATO boosters. The dark green/dark earth camouflage was the most common one.

Another view of MiG-21MF '687 Red'; note that the drop tanks are camouflaged, too.

No doubt the EGAF authorities were unaware that there was already a variant in the USSR designated MiG-21PFM (*izdeliye* 94), which was similar but sported a new canopy, a broader tailfin and a parabrake relocated from its original position under the fuselage to a faring below the rudder. Thus, when the *real* MiG-21PFMs arrived in East Germany they had to be given a different

All photos via RART

MiG-21M '570 Red' with RS-2-US and R-3S AAMs
JG 9, Peenemünde, 1967; note the 'winged Q' maintenance award badge

MiG-21M '588 Red' equipped with a CLA-87/I photo reconnaissance pod
TAFS 47, Preschen, 1988

MiG-21MF '774 Red' with R-3S AAMs and FFAR pods
JG 9, 1988

MiG-21MF '511 Red' with ten FAB-100 bombs (including eight on MERs)
JG 1, Holzdorf, 1990

MiG-21MF '652 Red' with three drop tanks
JG 1, 1990

via RART

▲ **A still unserialled MiG-21U (*izdeliye* 66-400) in EGAF markings.**

▶ **MiG-21UM '215 Black' in its original overall silver scheme. This aircraft was delivered to JG 9.**

Detlev Grass

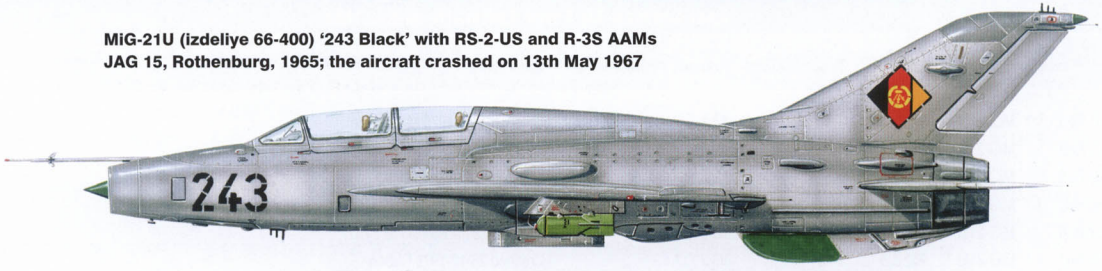
flaps which, when selected by the pilot, increased lift and reduced the landing and take-off runs. A new canopy was also fitted, with a fixed windshield and a hinged section opening to starboard; the KM-1 ejection seat could operate up to 25,000 m (82,000 ft) and at speeds between 130 and 1,200 km/h (about 80 to 750 mph). Further differences from the MiG-21PF were the new broader tailfin with the parabrake relocated from under the fuselage to just below the rudder. The new tail had previously been tried on the MiG-21FL (*izdeliye* 77) export version for India but this version did not have the other abovementioned innovations. As mentioned local designation, **MiG-21SPS**, by the EGAF in order to avoid confusion – thus creating more confusion.

A total of 52 MiG-21PFs were delivered, the first batch going to JG 8 at Marxwalde and the second to JG 1 'Fritz Schmenkel' at Cottbus. (The latter unit was named after a former soldier of the Wehrmacht who defected in 1941 to fight alongside Soviet partisans in Belorussia but was captured and executed by the Nazis in 1943, receiving the Hero of the Soviet Union title posthumously.) When the true MiG-21PFMs arrived in 1964-65 they re-equipped JG 1 and JG 8 whose old MiG-21PFs were then passed on to JG 2 and JG 9. Any survivors were withdrawn from service in 1988 and an attempt to sell 12 to Iran was unsuccessful.

The MiG-21PFM (*izdeliye* 94A), the next fighter variant to arrive, had the benefit of blown earlier, since the EGAF had already (mis)used the MiG-21PFM designation for MiG-21PF with improved avionics, the MiG-21PFM (*izdeliye* 94A) received the local designation MiG-21SPS, – a cross between the service designation and the manufacturer's designation Ye-7SPS (*sdoov pogranichnovo sloya*, Russian for 'boundary layer blowing'). The ability to carry a GP-9 gun pack under the fuselage was not available on the MiG-21PFM when the first machines were delivered. It was not until appoximately two years later that it was incorporated into new machines, which were designated locally **MiG-21SPS-K** (the K stood for *Kanone*, cannon). The two varieties are listed separately.

Altogether 82 MiG-21PFMs of the original cannon-less version were delivered, remaining in service until 1990. Some of them received Luftwaffe serial numbers after German reunifi-

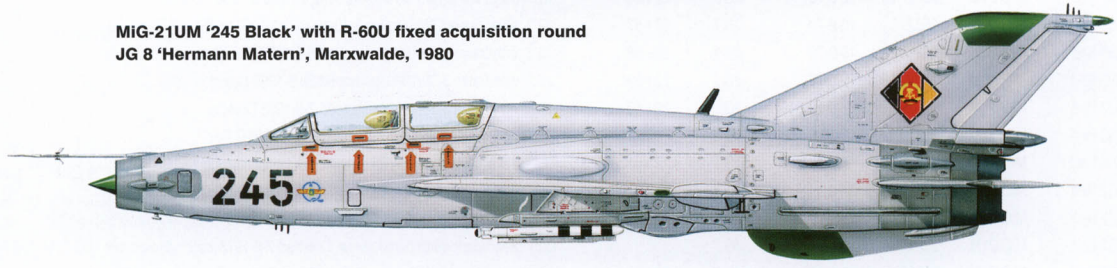
MiG-21U (izdeliye 66-400) '243 Black' with RS-2-US and R-3S AAMs
JAG 15, Rothenburg, 1965; the aircraft crashed on 13th May 1967



MiG-21U (izdeliye 66-600) '292 Black' with R-3U fixed acquisition round
JAG 15, 1989; note the 'winged Q' maintenance award badge

MiG-21US '250 Black' with R-3U fixed acquisition round
JG 1 'Fritz Schmenkel', Holzdorf, 1970

MiG-21UM '245 Black' with R-60U fixed acquisition round
JG 8 'Hermann Matern', Marxwalde, 1980



MiG-21UM '245 Black' with a CLA-87/II video reconnaissance pod
TAFS 47, Preschen, 1990

East German Air Force/Luftwaffe MiG-21Ms

EGAF serial	Version	C/n	In-service date	First unit	Luftwaffe ser.	Comments
401 Red	MiG-21M	962013	1-4-70	JG 8		Crashed 11-9-1970 Marxwalde
402 Red	MiG-21M	962014	1970	JG 8		28-10-1973 transferred to Syria
403 Red	MiG-21M	962015	1970?	JG 8		28-10-1973 transferred to Syria
406 Red	MiG-21M	962101	1970?	JG 8		28-10-1973 transferred to Syrian AF as 7602
407 Red	MiG-21M	962102	1970?	JG 8		28-10-1973 transferred to Syria
408 Red	MiG-21M	962103	3-70	JG 3		Crashed 28-12-1978 Guben
410 Red	MiG-21M	962104	19-12-69	JG 7	22+46	JG 2, withdrawn 3-10-1990, scrapped 2-11-1992 Dresden
412 Red	MiG-21M	962105	1970?	JG 8		28-10-1973 transferred to Syria
413 Red	MiG-21M	962106	8-1-70	JG 8	22+90	JG 7, TAFS 47, TAFS 87, silver overall. Withdrawn 3-10-1990; scrapped 26-4-1993 Dresden
414 Red	MiG-21M	962107	1970?	JG 8		28-10-1973 transferred to Syria
415 Red	MiG-21M	962108	1970?	JG 8		28-10-1973 transferred to Syrian AF as 7601
417 Red	MiG-21M	962109	3-70	JG 7		Silver overall. Crashed 20-9-1984 Eisenhüttenstadt
418 Red	MiG-21M	962110	1970?	JG 8		28-10-1973 transferred to Syria
419 Red	MiG-21M	962111	16-1-70	JG 3	22+47	JG 2, withdrawn 3-10-1990, scrapped 9-8-1993 Dresden
424 Red	MiG-21M	96????	1970?	JG 8		28-10-1973 transferred to Syrian AF as 7502
425 Red	MiG-21M	962308	5-70	JG 7	22+77	TAFS 47, withdrawn 3-10-1990, scrapped Dresden front fuselage preserved at Niederalteich
428 Red	MiG-21M	963204	29-8-70	JG 7	22+48	JG 2, silver overall. Withdrawn 3-10-1990, scrapped 26-5-1993 Dresden
430 Red	MiG-21M	963205	28-8-70	JG 7		1973 (?) renumbered 431 Red cf
431 Red (2)	MiG-21M	963205	see above	JG 2	22+49	Former 430 Red, JG 2, silver overall, Q-mark. Withdrawn 3-10-1990, scrapped Dresden 21-10-1992
432 Red	MiG-21M	963206	1-9-70	JG 7	22+50	JG 2, withdrawn 3-10-1990 scrapped 26-5-1993 Dresden
435 Red	MiG-21M	963207	1-9-70	JG 7	22+51	JG 2, silver overall. Withdrawn 3-10-1990, to TSLw 3 Fassberg 8-4-1992
438 Red	MiG-21M	963209	2-9-70	JG 7	22+52	JG 2, withdrawn 3-10-1990, scrapped 28-9-1994 Neuhardenburg (former Marxwalde) front fuselage preserved Neuenkirchen
445 Red	MiG-21M	963210	2-9-70	JG 7	22+53	JG 2, withdrawn 3-10-1990, scrapped 28-9-1994 Dresden
461 Red	MiG-21M	963212	3-9-70	JG 7	22+54	JG 2, withdrawn 3-10-1990, scrapped 29-6-1993 Dresden
464 Red	MiG-21M	963213	1970	JG 7		Written off 31-12-74 after accident. Later scrapped
465 Red	MiG-21M	963211	4-9-70	JG 7	22+55	JG 2, withdrawn 3-10-1990, scrapped 13-11-1992 Dresden
468 Red	MiG-21M	963214	12-9-70	JG 7	22+56	JG 3, JG 2, withdrawn 3-10-1990, scrapped 26-5-1993 Dresden
483 Red	MiG-21M	963215	10-9-70	JG 7	22+57	JG 2, silver overall. Withdrawn 3-10-1990, 1-2-1992 to TSLw 3 Fassberg
491 Red	MiG-21M	963301	15-9-70	JG 7	22+58	JG 2, withdrawn 3-10-1990, scrapped 5-8-1993 Dresden
493 Red	MiG-21M	963302	10-9-70	JG 7	22+59*	JG 2, withdrawn 3-10-1990, scrapped 29-9-1992 Dresden
497 Red	MiG-21M	963303	17-9-70	JG 7	22+60	JG 2, withdrawn 3-10-1990, scrapped 2-9-1993 Dresden
498 Red	MiG-21M	963304	11-70	JG 8		Crashed 7-8-1973 after collision with MiG-21M '507 Red'
499 Red	MiG-21M	963305	17-9-70	JG 7	22+61	JG 3, JG 2, silver overall. Withdrawn 3-10-1990, scrapped 26-9-1994 Neubrandenburg
502 Red	MiG-21M	963306	9-70	JG 7		Crashed 13-4-1971
505 Red	MiG-21M	963307	18-9-70	JG 3	22+62	JG 2, withdrawn 3-10-1990, TSLw 3 Fassberg, noted on show Holzdorf AB 8-2001
507 Red	MiG-21M	963308	1970	JG 7		Dark green/dark earth camouflage. Crashed 7-8-1973 after collision with MiG-21M '498 Red'
508 Red	MiG-21M	960307	20-12-68	JG 7	22+63	JG 2, silver overall. Withdrawn 3-10-1990, to TSLw 3 Fassberg 1-2-1994
515 Red	MiG-21M	960308	22-11-68	JG 9	22+64	JG 2, dark green/dark earth camouflage. Withdrawn 3-10-1990, to TSLw 3 Fassberg 1-2-1994
517 Red	MiG-21M	960309	7-69	JG 7	22+78	TFS 47, silver overall, Q-mark. Withdrawn 3-10-1990, scrapped 9-8-1993 Dresden
520 Red	MiG-21M	963309	1970	JG 7		Withdrawn 31-8-1974 after accident, later scrapped
523 Red	MiG-21M	960310	7-69	JG 9		JG 7, crashed 22-9-1978
526 Red	MiG-21M	960401	24-12-68	JG 9	22+65	JG 9, JG 7, JG 2, withdrawn 3-10-1990, scrapped 29-6-1993 Dresden
527 Red	MiG-21M	963310	11-70	JG 7	22+66	JG 2, withdrawn 3-10-1990, scrapped 9-11-1990 Dresden
531 Red	MiG-21M	960402	24-12-68	JG 9	22+91	JG 7, TFS 47, TFS 87, silver overall. Withdrawn 3-10-1990, scrapped 26-4-1993 Dresden
532 Red	MiG-21M	960403	1969	JG 9		JG 8, 28-10-1973 transferred Syria
541 Red	MiG-21M	960404	25-12-68	JG 9	22+67	JG 7, JG 2, withdrawn 3-10-1990, scrapped 2-9-1993 Dresden
542 Red	MiG-21M	963311	21-9-70	JG 7	22+68	JG 2, silver overall. Withdrawn 3-10-1990, scrapped 21-10-1993 Dresden
549 Red	MiG-21M	960405	24-12-68	JG 3	22+69	JG 3, JG 1, silver overall. Withdrawn 3-10-1990, scrapped 29-6-1993 Dresden

552 Red	MiG-21M	960406	7-69	JG 9	22+79	JG 7?, TAFS 47, withdrawn 3-10-1990 scrapped 9-8-1993 Dresden
553 Red	MiG-21M	960407	7-69	JG 9	22+80	JG 7?, TAFS 47, withdrawn 3-10-1990, scrapped 9-8-1993 Dresden but front fuselage preserved Speyer
555 Red	MiG-21M	960408	14-8-69	JG 9		Crashed Garz 26-10-1971
559 Red	MiG-21M	960409	8-69	JG 3	22+81	JG 2, TAFS 47, dark green/dark earth camouflage. Withdrawn 3-10-1990 scrapped 9-8-1993 Dresden
560 Red (2)	MiG-21M	960410	7-69	JG 9		Dark green/tan camouflage. Withdrawn 10-1-74 after accident, then training airframe OHS Kamenz, 17-1-1995 preserved Sömmerda Museum (see also MiG-21PFM table)
561 Red	MiG-21M	960501	24-1-69	JG 9	22+70	JG 7, JG 2, withdrawn 3-10-1990 scrapped 28-9-1994 Neubrandenburg
562 Red	MiG-21M	960502	7-69	JG 9	22+82	JG 7?, TAFS 47, withdrawn 3-10-1990 scrapped 7-5-1993 Dresden
565 Red	MiG-21M	963312	29-12-70	JG 7		Crashed 23-7-1971 Kattenborn
566 Red	MiG-21M	963313	2-10-70	JG 7	22+71	JG 2, withdrawn 3-10-1990 scrapped 29-6-1993 Dresden
568 Red	MiG-21M	960505	8-69	JG 3	22+83	23-7-1971 renumbered 571 Red cf
570 Red	MiG-21M	960503	27-1-69	JG 9	22+72	Silver overall, Q-mark. Withdrawn 3-10-1990, scrapped Dresden 9-8-1993
571 Red	MiG-21M	960505	see above	JG 3	22+83	Former 568 Red, TAFS 47, to Aerotec 26-8-1993, to Wölls-Peterhof 2000 as advertising platform, then Spieckendorf, later to Landsberg, reported 2006 Halle
573 Red	MiG-21M	963314	6-10-70	JG 7	22+73	JG 2, withdrawn 3-10-1990 scrapped 17-3-1993 Dresden
575 Red	MiG-21M	960504	31-1-69	JG 7	22+74	JG 2, withdrawn 3-10-1990 scrapped 26-5-1993 Dresden
578 Red	MiG-21M	960506	2-2-69	JG 7	22+75	JG 2, withdrawn 3-10-1990 scrapped 29-6-1993 Dresden
579 Red	MiG-21M	960507	8-69	JG 9	22+84	JG 7?, TAFS 47, silver overall; disguised as '5794 Red' at one time for publicity filming. Withdrawn 3-10-1990, to Aerotec 26-8-1993, Autohaus Tamsen, Bremen Seckenhausen 9-1997, Wölls Peterhof Autohaus, Bremen Osterholz 4-1999 painted red to advertise Ferrari cars
580 Red	MiG-21M	963315	7-10-70	JG 7	22+76	JG 2, withdrawn 3-10-1990, scrapped 20-9-1993 Dresden
581 Red	MiG-21M	960508	8-69	JG 9	22+85	JG 7?, TAFS 47, two-tone green camouflage, Q-mark. Withdrawn 3-10-1990, to Aerotec then preserved at Rothenburg Museum as EGAF '581 Red'
582 Red	MiG-21M	960509	1969	JG 8		28-10-1973 transferred to Syrian AF as 7603
583 Red	MiG-21M	960510	8-69	JG 7	22+92	JG 2, TAFS 87, dark green/dark earth camouflage, Q-mark. Withdrawn 3-10-1990, scrapped 8-11-1993 Dresden, cockpit reported at Savannah, GA, USA 10-2001
585 Red	MiG-21M	963401	9-10-70	JG 7		Crashed 28-8-1974
586 Red	MiG-21M	960511	8-69	JG 9		JG 7, written off 1-10-1976 after accident, then training airframe at OHS Kamenz; subsequent fate unknown
587 Red	MiG-21M	960512	6-2-69	JG 9	22+93	JG 7, TAFS 87, dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped 16-11-1993 Dresden.
588 Red	MiG-21M	960513	8-69	JG 9	22+86	JG 7, TAFS 47, green/brown camouflage. Withdrawn 3-10-1990, stored Dresden 29-9-1994, preserved 3-5-1997 Toulouse, France
589 Red	MiG-21M	960514	8-69	JG 9	22+87	JG 7?, TAFS 47, silver overall. Withdrawn 3-10-1990, stored Dresden, 15-6-1994 preserved Finow
590 Red	MiG-21M	960515	8-69	JG 9		JG 7, crashed Cottbus 16-3-1985
592 Red	MiG-21M	960601	15-8-69	JG 9		Crashed landing at Peenemünde 8-6-1970
594 Red	MiG-21M	960602	13-2-69	JG 9	22+94	JG 7, TAFS 47, TAFS 87, withdrawn 3-10-1990, scrapped Dresden 14-1-1993
595 Red	MiG-21M	960801	19-2-69	JG 9	22+95	JG 7, TAFS 87, withdrawn 3-10-1990, scrapped 17-3-1993 Dresden
596 Red	MiG-21M	960708	8-69	JG 9		Green/tan camouflage. Damaged beyond repair Peenemünde 26-6-1973 off, to OHS Kamenz as training airframe, later preserved Luftwaffe Museum as '596 Black' (!) without insignia
597 Red	MiG-21M	960705	28-2-69	JG 9	22+96	JG 7, TAFS 87, withdrawn 3-10-1990, scrapped Dresden 26-4-1993
602 Red	MiG-21M	960706	8-69	JG 9	22+88	JG 7, TAFS 47, withdrawn 3-10-1990, to Aerotec 30-11-1994
603 Red	MiG-21M	960707	5-3-69	JG 9	22+97	JG 7, TAFS 87, withdrawn 3-10-1990, scrapped Dresden 17-3-1993
607 Red	MiG-21M	960709	1969	JG 8		Written off 24-3-1972 (accident?), later scrapped
609 Red	MiG-21M	960711	6-3-69	JG 9	22+98	JG 7, TAFS 87, withdrawn 3-10-1990, scrapped Dresden 14-1-1993
610 Red	MiG-21M	960710	1969	JG 8		28-10-1973 transferred to Syria
611 Red	MiG-21M	961111	8-69	JG 9	22+89	JG 7, TAFS 87, dark green/dark earth camouflage. Withdrawn 3-10-1990, painted as '22 89' with Luftwaffe fin flash, scrapped Dresden 9-8-1993
614 Red	MiG-21M	960712	12-3-69	JG 7	22+99	TAFS 87, silver overall, Q-mark. Withdrawn 3-10-1990, scrapped Dresden 2-11-1992.
616 Red	MiG-21M	960713	12-3-69	JG 7	23+01	TAFS 87, withdrawn 3-10-1990, scrapped Dresden 24-2-1993
617 Red	MiG-21M	960714	1969	JG 8		Written off 10-5-1973 (accident?), later to Dresden and scrapped
621 Red	MiG-21M	960715	14-3-69	JG 9	23+02	JG 7, TAFS 87, withdrawn 3-10-1990, scrapped 26-4-1993 Dresden

East German Air Force/Luftwaffe MiG-21MFs

EGAF serial	Version	C/n	In-service date	First unit	Luftwaffe serial	Comments
427 Red	MiG-21MF	967603	24-5-73	JG 9	23+03	JG 3, JG 1, dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped Dresden 14-9-1993
430 Red	MiG-21MF	967604	25-5-73	JG 9	23+04	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 26-5-1993
437 Red	MiG-21MF	967605	25-5-73	JG 9	23+05	JG 1, withdrawn 3-10-1990, scrapped 26-4-1993 Dresden
447 Red	MiG-21MF	967606	3-7-73	JG 9		JG 8, crashed 17-8-1977 after bird strike
448 Red	MiG-21MF	967607	27-5-73	JG 9	23+06	JG 8, JG 9, JG 3, JG 1, dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped 7-10-1993 Dresden, or to Rothenburg Museum as '7607'??
460 Red	MiG-21MF	967608	27-5-73	JG 9	23+07	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 26-4-1993
467 Red	MiG-21MF	967610	28-5-73	JG 9	23+08	JG 3, JG 1, green/tan camouflage. Withdrawn 3-10-1990, scrapped Dresden 26-5-1993, cockpit at Technikmuseum Speyer
470 Red	MiG-21MF	967609	5-6-73	JG 9	23+09	JG 8, JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 12-1-1993
473 Red	MiG-21MF	967612	6-6-73	JG 9	23+10	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 26-4-1993
477 Red	MiG-21MF	967613	8-6-73	JG 9	23+11	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 13-10-1993
478 Red	MiG-21MF	967614	8-6-73	JG 9	23+12	JG 3, JG 1, green/tan camouflage, Q-mark. Withdrawn 3-10-1990, scrapped Dresden 7-10-1993
490 Red	MiG-21MF	967615	12-6-73	JG 9	23+13*	JG 8, JG 9, JG 3, JG 1, green/tan camouflage. Withdrawn 3-10-1990, scrapped Dresden 16-11-1992
507 Red	MiG-21MF	968606	30-1-74	JG 9		JG 3, collided with 766 and crashed Torgau 21-4-1988
509 Red	MiG-21MF	968609	22-11-73	JG 9	23+14	JG 3, JG 1, dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped Dresden 26-4-1993
510 Red	MiG-21MF	968615	20-11-73	JG 9	23+15*	JG 3, JG 1, dark green/dark earth camouflage; sharkmouth and 'JG 1' fin titles added later; withdrawn 3-10-1990, scrapped Dresden 13-11-1992
511 Red	MiG-21MF	968611	29-11-73	JG 9	23+16	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 17-3-1993
512 Red	MiG-21MF	968701	30-1-74	JG 9		Crashed Rügen Island 25-6-1975
513 Red	MiG-21MF	968613	25-11-73	JG 9	23+17*	JG 3, JG 1, dark green/dark earth camouflage; disguised as '1513 Red' at one time for publicity filming. Withdrawn 3-10-1990, to WTD 61 Manching 8-4-1991, 3-1993 WTD 52 Oberjettenberg
514 Red	MiG-21MF	968614	25-11-73	JG 9	23+18	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 11-10-1993
516 Red	MiG-21MF	968610	29-11-73	JG 9	23+19	JG 3, JG 1, dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped Dresden 14-10-1993
518 Red	MiG-21MF	968608	22-11-73	JG 9	23+20	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 26-4-1993
529 Red	MiG-21MF	969008	20-2-74	JG 9		Dark green/dark earth camouflage. Written off 5-9-1980 after accident, then training airframe at MTS Bad Düben, preserved 2-3-1993 Ankum, later Rügen Museum
535 Red	MiG-21MF	969009	20-2-74	JG 9	23+21	JG 3, JG 1, dark green/dark earth camouflage; disguised as '1535 Red' at one time for publicity filming. Withdrawn 3-10-1990, scrapped Dresden 26-4-1993.
548 Red	MiG-21MF	968612	14-12-73	JG 9	23+22	JG 3, JG 1, withdrawn 3-10-1990, scrapped 2-9-1993 Dresden
649 Red	MiG-21MF	965306	23-2-72	JG 8	23+23	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 13-10-1997
650 Red	MiG-21MF	965307	2-3-72	JG 9?	23+24	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 14-9-1993, cockpit at Savannah, GA, USA
651 Red	MiG-21MF	965308	7-3-72	JG 8	23+25	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 26-4-1993
652 Red	MiG-21MF	965310	6-3-72	JG 3	23+26	JG 1, withdrawn 3-10-1990, scrapped Dresden 11-10-1993
653 Red	MiG-21MF	965311	28-4-72	JG 3		Written off 26-4-1977, first at Dresden then as training airframe at OHS Kamenz, preserved 14-6-1993 Cottbus
654 Red	MiG-21MF	965312	4-1972	JG 3		Crashed 23-6-1973 at Coswig after colliding with MiG-21MF '656 Red' over Dresden
656 Red	MiG-21MF	965309	3-1972	JG 3		Crashed Dresden 23-6-1973 after colliding with MiG-21MF '654 Red'
657 Red	MiG-21MF	965313	14-3-72	JG 8	23+27	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 2-11-1992
658 Red	MiG-21MF	965314	5-1972	JG 8	23+38	JG 3, withdrawn 3-10-1990, Motorfliegerclub Bad Wörishofen 8-11-1994
659 Red	MiG-21MF	965315	15-3-72	JG 8	23+28	JG 3, JG 1, silver overall. Withdrawn 3-10-1990, Dresden scrapped 17-9-1993
660 Red	MiG-21MF	965401	20-3-72	JG 8	23+29	JG 3, JG 1, silver overall. Withdrawn 3-10-1990, scrapped Dresden 2-9-1993
662 Red	MiG-21MF	965402	18-3-72	JG 8	23+30	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 12-1-1993
664 Red	MiG-21MF	965403	18-3-72	JG 8	23+31	JG 3, JG 1, silver overall. Withdrawn 3-10-1990, scrapped Dresden 26-5-1993
665 Red	MiG-21MF	965404	23-3-72	JG 8	23+32	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 16-11-1993
667 Red	MiG-21MF	966205	26-8-72	JG 8	23+33	JG 3, JG 1, withdrawn 3-10-1990, scrapped Dresden 26-4-1993
670 Red	MiG-21MF	966206	26-8-72	JG 3		Written off 15-12-1984, Dresden, then training airframe at MTS Bad Düben, at Police Sports Club Dessau 16-6-1993, preserved 2000 Merseburg Museum
673 Red	MiG-21MF	966207	26-8-72	JG 3		Dark green/dark earth camouflage. Written off 9-12-1981, Dresden, then training airframe MTS Bad Düben, at Police Sports Club Dessau 16-6-1993, preserved 2000 Merseburg Museum
674 Red	MiG-21MF	966208	8-1972	JG 3		Crashed near Senftenberg 30-8-1973
675 Red	MiG-21MF	966209	26-8-72	JG 3	23+34	JG 1, withdrawn 3-10-1990, scrapped Dresden 26-4-1993

680 Red	MiG-21MF	966210	28-8-72	JG 3	23+35	JG 1, withdrawn 3-10-1990, scrapped Dresden 7-10-1993
681 Red	MiG-21MF	966211	28-8-72	JG 3	23+39	JG 8, JG 3, withdrawn 3-10-1990, to Aerotec 30-11-1994
682 Red	MiG-21MF	966212	9-1972	JG 3		Collided with Mil' Mi-4 '578 Black' and crashed 6-9-1976
683 Red	MiG-21MF	966213	7-9-72	JG 3	23+36	JG 1, withdrawn 3-10-1990, scrapped Dresden 26-5-1993
685 Red	MiG-21MF	966214	6-9-72	JG 3	23+37	JG 1, dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped Dresden 2-9-1993
686 Red	MiG-21MF	966301	11-1972	JG 8		Dark green/dark earth camouflage. Written off 26-4-1977 Dresden, then training airframe OHS Kamenz, 1994 preserved Luftwaffe Museum
687 Red	MiG-21MF	966215	9-1-73	JG 3	23+40	Two-tone green camouflage. Withdrawn 3-10-1990, preserved 6-12-1993 Oberschleissheim Museum, Munich, as '23 40' with Luftwaffe fin flash, later as EGAF '687 Red'
765 Red	MiG-21MF*	96001085	5-1975	JG 9		1975 renumbered 773 Red cf
766 Red	MiG-21MF*	96001001	5-1975	JG 9		Collided with '507 Red' and crashed 21-4-1988 Torgau
767 Red	MiG-21MF*	96001012	5-1975	JG 9	23+41	JG 3, withdrawn 3-10-1990, preserved 5-7-1994 Seifertshofen
772 Red	MiG-21MF*	96001039	5-1975	JG 9	23+42	JG 3, withdrawn 3-10-1990, preserved 11-10-1994 Rimini, Italy
773 Red	MiG-21MF*	see above	5-1975	JG 9		Former 765 Red renumbered 1975, crashed Peenemünde 29-3-1976
774 Red	MiG-21MF*	96001091	5-1975	JG 9	23+43	JG 3, silver overall. Withdrawn 3-10-1990, preserved 25-5-1994 Hermeskeil, 5-1999 Musée du Château de Savigny (Savigny-lès-Beaune, France)
775 Red	MiG-21MF*	96002003	5-1975	JG 9	23+44	JG 8, JG 3, light grey overall. Withdrawn 3-10-1990, preserved Hermeskeil 22-10-1993
776 Red	MiG-21MF*	96002009	5-1975	JG 9	23+45	JG 8, JG 3, dark green/dark earth camouflage; disguised as '1776 Red' at one time for publicity filming. Withdrawn 3-10-1990, preserved Trenton, Canada 12-9-1993
777 Red	MiG-21MF*	96002022	5-1975	JG 9		Crashed into Baltic Sea 19-9-1980
779 Red	MiG-21MF*	96002045	5-1975	JG 9	23+46	JG 3, withdrawn 3-10-1990, Aerotec 30-11-1994, 1999 to Kunstpark H. Olmes, Emlichheim (noted 6-2002)
781 Red	MiG-21MF*	96002037	5-1975	JG 9	23+47	JG 3, withdrawn 3-10-1990, at Dresden, then to Aerotec 1994, displayed Neubrandenburg 1999, preserved 2001 Neuenkirchen as 781
782 Red	MiG-21MF*	96002112	5-1975	JG 9	23+48	JG 3, dark green/dark earth camouflage, Q-mark. Withdrawn 3-10-1990, preserved 10-1-1994 Motortechnica Museum, Bad Oeyenhausen as '22+28'
784 Red	MiG-21MF*	96002170	5-1975	JG 9	23+49	JG 3, two-tone green camouflage, Q-mark. Withdrawn 3-10-1990, preserved 26-8-1993, then to Aerotec, preserved 2001 in Rothenburg Museum as EGAF '784 Red'

cation but were not considered standard types and did not equip line regiments. Luftwaffe serials consist of two pairs of digits separated by the *Balkenkreuz* national insignia, the first two digits being a code for the given aircraft type. However, since the crosses are only applied to aircraft in active service, very few MiG-21s nominally taken over by the Luftwaffe actually wore them; most had a blank space between the two pairs of digits. Confirmed examples that did actually wear *Balkenkreuze* are marked * in the appropriate column – for example, 23+51*.

The updated version of the MiG-21PFM (*izdeliye* 94A) compatible with the GP-9 gun pod entered EGAF service in December 1967, and the order was fulfilled in May 1968 with the delivery of the 54th aircraft. JG 1 completed its requirements and JG 9 re-equipped with the cannon-armed MiG-21PFM ('MiG-21SPS-K'). When replaced by more modern versions the aircraft from these Wings were redeployed to JG 2, JG 7 and the JAG 15 training wing (later redesignated FAG 15).

Survivors were withdrawn from service in late 1990. JG 1 and JG 2 both had a squadron of 'MiG-21SPS-Ks' until they were formally disbanded.

Third-generation MiG-21s started to arrive in East Germany in November 1968. They were built by MMZ No. 30 'Znamya Truda' in Moscow, at the same time as *zavod* 21 in Gor'kiy was completing MiG-21S production and switching to the MiG-21SM, both types heading for the Soviet Air Force. Thus the MiG-21M (*izdeliye* 96) could be considered as the export version of either the MiG-21S with a built-in cannon or the MiG-21SM with a less powerful R11F2S-300 turbojet and a less sophisticated radar.

'936 Red' No. 2, a MiG-21*bis* (*izdeliye* 75B) of JG 8. The aircraft inherited this serial from a MiG-21PF written off in 1972. ▼

Martin Baumann

MiG-21bis (izdeliye 75A) '871 Red' with R-3R and R-3M missiles
JG 9, Peenemünde, 1975
871
MiG-21bis (izdeliye 75A) '872 Red' equipped with an ECM pod
JG 8, Marxwalde
872
MiG-21bis (izdeliye 75B) '794 Red' with R-3R and R-60M missiles
JG 8, 1990
794
M.MEYER

East German Air Force/Luftwaffe MiG-21*bis* (part 1 – *Fishbed-L*)

EGAF serial	Version	C/n	In-service date	First unit	Luftwaffe serial	Comments
871 Red	MiG-21*bis* (*izd.* 75A)	75033148	16-10-75	JG 9	24+26	JG 8, withdrawn 3-10-1990, scrapped Dresden 29-6-1993
872 Red	MiG-21*bis* (*izd.* 75A)	75033151	16-10-75	JG 9	24+27	JG 8, withdrawn 3-10-1990, scrapped Dresden 17-3-1993
873 Red	MiG-21*bis* (*izd.* 75A)	75033169	8-1975	JG 9	24+28*	JG 8, green/tan camouflage. Withdrawn 3-10-1990, 28-10-1993 to Josef Koch Museum, Augsburg; later sold to private owner at Tannheim, then Ruppichteroth (noted 10-2002).\
874 Red	MiG-21*bis* (*izd.* 75A)	75033205	16-10-75	JG 9	24+29	JG 8, withdrawn 3-10-1990, Dresden Military Museum 19-6-1992 as '24 29', two-tone green camouflage, Luftwaffe fin flash but no Balkenkreuze. Later preserved Brussels, Belgium; currently loaned to 1 Wing Museum, Beauvechain
875 Red	MiG-21*bis* (*izd.* 75A)	75033211	16-10-75	JG 9	24+30	JG 8, withdrawn 3-10-1990, to Police Sports Club 21-5-1994 then preserved Dessau later on show at Freytag car towing centre, Staffelde (noted 2000)
876 Red	MiG-21*bis* (*izd.* 75A)	75033213	16-10-75	JG 9	24+31	JG 8, withdrawn 3-10-1990, scrapped Dresden 29-6-1993
879 Red	MiG-21*bis* (*izd.* 75A)	75033219	7-1975	JG 9	24+32	JG 8, withdrawn 3-10-1990, scrapped Dresden 24-2-1993
881 Red	MiG-21*bis* (*izd.* 75A)	75033305	7-1975	JG 9	24+33	JG 8, withdrawn 3-10-1990, scrapped Dresden 8-1-1993
882 Red (2)	MiG-21*bis* (*izd.* 75A)	75033397	7-1975	JG 9	24+34	JG 8, silver overall, later dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped Dresden 24-2-1993
886 Red	MiG-21*bis* (*izd.* 75A)	75033419	30-4-75	JG 9	24+35	JG 8, dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped Dresden 17-3-1993
892 Red	MiG-21*bis* (*izd.* 75A)	75033445	6-1975	JG 9	24+37	JG 8, light grey overall. Withdrawn 3-10-1990, scrapped Dresden 14-1-1993

893 Red	MiG-21*bis* (*izd.* 75A)	75033507	6-1975	JG 9	24+38	JG 8, withdrawn 3-10-1990, scrapped Dresden 12-1-1993, cockpit preserved there
895 Red	MiG-21*bis* (*izd.* 75A)	75033515	30-4-75	JG 9	24+39	JG 8, withdrawn 29-6-1990, scrapped Dresden 29-6-1993
899 Red	MiG-21*bis* (*izd.* 75A)	75033522	6-1975	JG 9	24+40	JG 8, dark green/dark earth camouflage, Q-mark. Forced landing in Möncheberg 1980, repaired, withdrawn 3-10-1990, scrapped Dresden 12-1-1993

East German Air Force/Luftwaffe MiG-21*bis* (part 2 – *Fishbed-N*)

EGAF serial	Version	C/n	In-service date	First unit	Luftwaffe serial	Comments
792 Red	MiG-21*bis* (*izd.* 75B)	75051035	8-1977	JG 8	24+13	Withdrawn 3-10-1990, scrapped Dresden 12-1-1993
794 Red	MiG-21*bis* (*izd.* 75B)	75051108	8-1977	JG 8	24+14	Withdrawn 3-10-1990, scrapped Dresden 26-4-1993
797 Red	MiG-21*bis* (*izd.* 75B)	75051121	9-1977	JG 8	24+15	Dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped Dresden 17-3-1993
835 Red	MiG-21*bis* (*izd.* 75B)	75051345	8-1977	JG 8	24+16	Withdrawn 3-10-1990, scrapped Dresden 12-1-1993
837 Red	MiG-21*bis* (*izd.* 75B)	75051347	6-1977	JG 8	24+17	Withdrawn 3-10-1990, scrapped Dresden 24-2-1993
838 Red	MiG-21*bis* (*izd.* 75B)	75051378	9-1977	JG 8	24+18	Green/tan camouflage, Q-mark. Withdrawn 3-10-1990, to Aerotec 17-3-1995, later preserved Rothenburg Museum as EGAF '838 Red'
840 Red	MiG-21*bis* (*izd.* 75B)	75051384	9-1977	JG 8	24+19	Withdrawn 3-10-1990, scrapped Dresden 12-1-1993
844 Red	MiG-21*bis* (*izd.* 75B)	75051400	9-1977	JG 8		Crashed 19-2-1990 in Poland
846 Red	MiG-21*bis* (*izd.* 75B)	75051402	19-10-77	JG 8	24+20	Withdrawn 3-10-1990, WTD-61 Manching for trials 10-4-1991, preserved 4-1994 Koblenz as Soviet Air Force '2'
848 Red (2)	MiG-21*bis* (*izd.* 75B)	75051405	9-1977	JG 8	24+21	Green/tan camouflage. Withdrawn 3-10-1990, preserved 14-6-1993 Cottbus as EGAF '848 Red'; see MiG-21PF
849 Red	MiG-21*bis* (*izd.* 75B)	75051426	19-10-77	JG 8	24+22*	Green/tan camouflage. Withdrawn 3-10-1990, scrapped Dresden 12-1-1993
850 Red	MiG-21*bis* (*izd.* 75B)	75058003	17-5-78	JG 8	24+23	Withdrawn 3-10-1990, scrapped Dresden 17-1-1993
853 Red	MiG-21*bis* (*izd.* 75B)	75058015	17-5-78	JG 8	24+24	Withdrawn 3-10-1990, preserved 28-9-1994 Hermeskeil in green/tan camouflage as '24 24' without insignia; later reverted to '853 Red' in refreshed camouflage but still without insignia
856 Red	MiG-21*bis* (*izd.* 75B)	75058087	17-5-78	JG 8	24+25	Green/grey camouflage. Withdrawn 3-10-1990, to Aerotec 20-3-1995, later to Classic Aircraft Club, Schweinfurt, noted 2006 preserved Alten as '24 25' without insignia
859 Red	MiG-21*bis* (*izd.* 75B)	75058099	17-5-78	JG 8		Crashed 21-11-1986 in Poland
887 Red	MiG-21*bis* (*izd.* 75B)	75035190	14-7-76	JG 9	24+36	JG 8, withdrawn 3-10-1990, scrapped Dresden 24-2-1993
900 Red	MiG-21*bis* (*izd.* 75B)	75035201	6-1976	JG 9	24+41	JG 8, withdrawn 3-10-1990, scrapped Dresden 24-2-1993
904 Red	MiG-21*bis* (*izd.* 75B)	75035213	6-1976	JG 9	24+42	JG 8, withdrawn 3-10-1990, scrapped Dresden 17-3-1993
916 Red	MiG-21*bis* (*izd.* 75B)	75035284	6-1976	JG 9	24+43	JG 8, dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped Dresden 24-2-1993
917 Red	MiG-21*bis* (*izd.* 75B)	75035289	6-1976	JG 9	24+44	JG 8, damaged 3-8-1979 (or 16-8-1979?) in a collision with MiG-21*bis* '941 Red', repaired, withdrawn 3-10-1990, scrapped Dresden 24-2-1993
920 Red	MiG-21*bis* (*izd.* 75B)	75035291	6-1976	JG 9	24+45	JG 8, withdrawn 3-10-1990, scrapped Dresden 17-3-1993
933 Red	MiG-21*bis* (*izd.* 75B)	75035304	6-1976	JG 9	24+46	JG 8, withdrawn 3-10-1990, scrapped Dresden 16-11-1993
936 Red (2)	MiG-21*bis* (*izd.* 75B)	75035374	31-5-76	JG 9	24+47	JG 8, dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped Dresden 14-1-1993; see MiG-21PF table
941 Red	MiG-21*bis* (*izd.* 75B)	75035385	16-7-76	JG 9		JG 8, collided with MiG-21*bis* '917 Red' over Poland and crashed near Finkenherd 3-8-1979 (or 16-8-1979?)
946 Red	MiG-21*bis* (*izd.* 75B)	75035399	6-1976	JG 9	24+48	JG 8, withdrawn 3-10-1990, scrapped Dresden 24-2-1993
950 Red (2)	MiG-21*bis* (*izd.* 75B)	75035400	6-1976	JG 9		JG 8, crashed 9-3-1983; see MiG-21PF table
951 Red	MiG-21*bis* (*izd.* 75B)	75035407	6-1976	JG 9	24+49	JG 8, 24-2-1993, dark green/dark earth camouflage
954 Red	MiG-21*bis* (*izd.* 75B)	75035422	6-1976	JG 9	24+50	JG 8, withdrawn 3-10-1990, scrapped Dresden 26-5-1993
956 Red	MiG-21*bis* (*izd.* 75B)	75035445	16-7-76	JG 9	24+51	JG 8, withdrawn 3-10-1990, scrapped Dresden 14-1-1993
957 Red	MiG-21*bis* (*izd.* 75B)	75035501	6-1976	JG 9		JG 8, crashed near Joachimstal 20-2-1987
978 Red	MiG-21*bis* (*izd.* 75B)	75035502	31-5-76	JG 9	24+52	JG 8, withdrawn 3-10-1990, scrapped Dresden 24-2-1993
990 Red	MiG-21*bis* (*izd.* 75B)	75035841	6-1976	JG 9	24+53	JG 8, two-tone green camouflage, withdrawn 3-10-1990, preserved 23-11-1994 Luftwaffe Museum as '24 53' without insignia

East German Air Force/Luftwaffe MiG-21U trainers

EGAF serial	Version	C/n	In-service date	First unit	Luftwaffe serial	Comments
235 Black	MiG-21U (*izd.* 66-400)	660818	5-4-65	JAG 15		JG 2, withdrawn 7-1990 and scrapped
237 Black	MiG-21U (*izd.* 66-400)	661119	5-4-65	JAG 15	23+86	Withdrawn 3-1990, preserved Bad Ischl, Austria
239 Black	MiG-21U (*izd.* 66-400)	660917	5-4-65	JAG 15		Withdrawn 6-1989 and scrapped 1990
241 Black	MiG-21U (*izd.* 66-400)	660918	1-4-65	JAG 15		JG 2, crashed Waren, Müritz 12-7-1980
243 Black	MiG-21U (*izd.* 66-400)	660920	5-4-65	JAG 15		Silver overall. Crashed Rothenburg 13-5-1967
244 Black	MiG-21U (*izd.* 66-400)	661017	22-6-65	JG 1	23+87	JAG 15, JG 3, JAG 15, dark green/dark earth camouflage. Withdrawn 3-1990, later to Aerotec
245 Black	MiG-21U (*izd.* 66-400)	660916	1-4-65	JAG 15		Crashed Lodenau 9-8-1976
247 Black	MiG-21U (*izd.* 66-400)	661020	22-6-65	JG 1		JAG 15, withdrawn 3-1990 and scrapped 1-6-1990
249 Black	MiG-21U (*izd.* 66-400)	661116	15-12-64	JG 9		Crashed 25-8-1971 in Poland
251 Black	MiG-21U (*izd.* 66-400)	661016	22-6-65	JG 9	23+88	JG 2, JAG 15, JG 3, withdrawn 3-1990 and preserved 14-11-1994 Sömmerda
253 Black	MiG-21U (*izd.* 66-400)	661019	1-6-65	JG 1		JG 3, crashed Kölzig 10-5-1969
255 Black	MiG-21U (*izd.* 66-400)	661018	13-12-64	JG 1		JG 3, JAG 15, crashed Steinbach 9-7-1973
258 Black	MiG-21U (*izd.* 66-400)	661118	18-5-65	JG 3	23+89	Withdrawn 3-1990, preserved 6-10-1993 Dessau as '23 19' in dark green/dark earth camouflage without insignia
260 Black	MiG-21U (*izd.* 66-400)	660819	1-6-65	JG 3		Dark green/dark earth camouflage. Withdrawn 3-1990, Kamenz 7-5-1990 for chemical exercises, scrapped 8-6-1991
261 Black	MiG-21U (*izd.* 66-600)	662420	2-6-66	JAG 15		11-12-1969 forced landing, repaired, withdrawn 3-1990 and scrapped
263 Black	MiG-21U (*izd.* 66-600)	662516	9-3-66	JAG 15		Crashed Reitschen 20-6-1974
265 Black	MiG-21U (*izd.* 66-600)	662617	13-8-66	JAG 15	23+90	Withdrawn 3-1990, preserved 24-11-1994 Ankum Museum
271 Black	MiG-21U (*izd.* 66-600)	662618	13-8-66	JAG 15		Silver overall. Crashed at Nochten gunnery range 11-5-1976
272 Black	MiG-21U (*izd.* 66-600)	662619	13-8-66	JAG 15	23+91	Withdrawn 3-1990, preserved 12-1-1994 Bad Oeynhausen
273 Black	MiG-21U (*izd.* 66-600)	662620	13-8-66	JAG 15		Crashed Zittau 4-7-1974
274 Black	MiG-21U (*izd.* 66-600)	663218	26-9-66	JAG 15		Withdrawn 3-1990, scrapped 1-6-1990
275 Black	MiG-21U (*izd.* 66-600)	663219	15-7-66	JAG 15	23+92	Silver overall. Withdrawn 3-1990, to Aerotec, from 29-6-1999 at Stammheim (noted 8-2001)
276 Black	MiG-21U (*izd.* 66-600)	663220	26-09-66	JAG 15	23+93	Withdrawn 3-1990, to Aerotec, from 2000 at Lintel (noted 8-2002)
277 Black	MiG-21U (*izd.* 66-600)	663315?	1966	JG 3		No details known
278 Black	MiG-21U (*izd.* 66-600)	663316	29-9-66	JAG 15		Withdrawn 18-11-1988, Dresden intended for Iraq, scrapped Dresden c.1991
279 Black	MiG-21U (*izd.* 66-600)	663818	29-12-66	JG 3		Crashed 16-4-1969 in Poland
280 Black	MiG-21U (*izd.* 66-600)	663819	29-12-66	JG 3		Crashed 14-5-1970 Preschen
281 Black	MiG-21U (*izd.* 66-600)	663820	17-2-67	JG 1	23+94	JG 2, JAG 15, withdrawn 3-1990, preserved European Fighter Aviation Museum (Montélimar, France) 11-11-1994 in two-tone green camouflage as '23 94' but with EGAF insignia!
282 Black	MiG-21U (*izd.* 66-600)	663916	17-2-67	JG 1		JG 3, JG 1, JG 3, JAG 15, dark green/dark earth camouflage. Withdrawn 3-1990, scrapped 1-6-1990
283 Black	MiG-21U (*izd.* 66-600)	664518	29-5-67	JG 1		JG 3, JG 2, JAG 15, withdrawn 3-1990, scrapped 1-6-1990
284 Black	MiG-21U (*izd.* 66-600)	664519	29-5-6	JG 1		JG 8, JG 2, JAG 15, dark green/dark earth camouflage. Withdrawn 3-1990 and scrapped
285 Black	MiG-21U (*izd.* 66-600)	664520	1-6-67	JG 1		Silver overall. Crashed 10-1-1970 when landing short of airfield, cockpit at Rimini, Italy (noted 3-2002)
286 Black	MiG-21U (*izd.* 66-600)	664616	21-4-67	JG 8		JG 3, crashed 29-8-1972 in Poland
288 Black	MiG-21U (*izd.* 66-600)	664617	21-4-67	JG 8		Forced landing 29-11-1967, repaired, JAG 15, withdrawn 18-11-1988, stored Dresden for export to Iran, not known if delivered
289 Black	MiG-21U (*izd.* 66-600)	664620	23-5-67	JG 9	23+95	JG 2, JAG 15, withdrawn 3-1990, preserved 11-11-1994 Sömmerda
290 Black	MiG-21U (*izd.* 66-600)	664716	1-5-67	JG 9		JG 2, JG 7, JG 15, withdrawn 18-11-1988, stored Dresden for export to Iran, not known if delivered
291 Black	MiG-21U (*izd.* 66-600)	664718	1-5-67	JG 7		JG 2, JG 7, JG 15, withdrawn 18-11-1988, stored Dresden for export to Iran, sold instead as N121TJ Mojave, CA, USA
292 Black	MiG-21U (*izd.* 66-600)	664719	5-7-67	JG 8	23+96	JAG 15, two-tone green camouflage, Q-mark. Withdrawn 3-1990, to Aerotec 10-1990, then Osnabrück, preserved 7-2002 Rechlin-Lärz Museum
293 Black	MiG-21U (*izd.* 66-600)	664720	1-5-67	JG 8		JG 3, LG 7, AFS 31, JAG 15, withdrawn 3-1990 noted 2-1993 on the Rothenburg dump, later scrapped
294 Black	MiG-21U (*izd.* 66-600)	664816	1-6-67	JG 8		JAG 15, withdrawn 3-1990, fire practice OHS Kamenz 7-5-1990, scrapped 8-6-1991

295 Black	MiG-21U (*izd.* 66-600)	664817	8-6-67	JAG 15	23+97	Withdrawn 3-1990, to Porta Westfilica Museum, now Heidepark Soltau
296 Black	MiG-21U (*izd.* 66-600)	664818	20-7-67	JG 3	23+98	JG 8, JG 3, AFS 31, JAG 15, silver overall. Withdrawn 3-1990, to Aerotec, then Rothenburg Museum as EGAF '296 Black' in two-tone green camouflage
297 Black	MiG-21U (*izd.* 66-600)	664819	1-6-67	JG 8		JAG 15, withdrawn 3-1990, fire practice OHS Kamenz 7-5-1990, to Aerotec 15-3-1995 (noted 5-1999)
298 Black	MiG-21U (*izd.* 66-600)	665118	1-6-67	JG 9		JG 2, JAG 15, crashed 1-8-1975 near Brunn
299 Black	MiG-21U (*izd.* 66-600)	665119	10-3-67	JG 9		JG 2, crashed 10-12-1968 Neubrandenburg

Deliveries continued until December 1970, by which time 87 were in service. The first units to receive them were JG 8 and JG 9, followed by JG 7. However, the MiG-21M fleet was depleted by the sale of 12 to Syria in 1973 to offset that country's losses in one of its numerous wars with Israel. After a reorganisation, JG 3 received the MiG-21M in 1988 and JG 2 similarly in 1989. In the meantime, to fulfil CFE Treaty obligations, JG 7 was disbanded on 1st September 1989, its aircraft being redistributed to JG 2, TAFS 47 and TAFS 87. The reconnaissance equipment was supplied by German companies and the CL-85, CLA-87/I, CLA-87/II or CLA-87/III camera pod was carried on the inner starboard wing pylon; all four were conversions of the UB-16-57A rocket pod. The first two models featured Carl Zeiss-Jena vertical still cameras, the CLA-87/III (*Container für Luftaufklärung* – aerial reconnaissance pod, 1987 model, version III) had both

East German Air Force/Luftwaffe MiG-21USs

EGAF serial	Version	C/n	In-service date	First unit	Luftwaffe serial	Comments
215 Black	MiG-21US	01685134	31-7-68	JG 9	23+99	JG 2, FAG 15, silver overall (disguised as '2153 Black' at one time for publicity filming), later two-tone green camouflage. Withdrawn 10-1990, stored Rothenburg, preserved 3-11-1993 Cottbus as EGAF '215 Black'
217 Black	MiG-21US	07685145	17-2-70	JG 7	24+01	JG 2, JG 3, FAG 15, light grey overall, Q-mark. Withdrawn 10-1990, stored Rothenburg, preserved 24-8-1984 Ankum Museum
218 Black	MiG-21US	08685145	21-2-70	JG 3	24+02	JG 7, JG 2, FAG 15, withdrawn 10-1990, stored Rothenburg, 13-8-1990 to Dresden, preserved 29-9-1994 Dresden Airport at Elbe Flugzeugwerke
219 Black	MiG-21US	09685145	24-2-70	JG 7	24+03	Light grey overall. Withdrawn 10-1990, stored Rothenburg, to Dresden, preserved 29-9-94 Elbe Flugzeugwerke, Dresden, then 2001 to Oyten, Bremen (noted 8-2001)
220 Black	MiG-21US	06685147	8-1970	JG 7		Light grey overall. Crashed Malchin 11-8-1978
221 Black	MiG-21US	07685147	30-5-70	JG 3	24+04	Dark green/dark earth camouflage. Withdrawn 10-1990, stored Rothenburg, preserved 18-4-1994 Fichtelberg Museum as '24 04' without insignia
222 Black	MiG-21US	10685147	6-1970	JG 3		Crashed 17-4-1974
225 Black	MiG-21US	02685134	27-8-68	JG 1	24+05	Withdrawn 10-1990, stored Rothenburg, preserved Luftsportgemeinschaft Flugplatz Bayreuth 20-4-1994 (noted 4-2001)
228 Black	MiG-21US	03685134	19-12-68	JG 9		Light grey overall, silver nose, Q-mark. Crashed Rügen Island 25-7-1971
230 Black	MiG-21US	04685134	27-9-68	JG 1	24+06	Withdrawn 10-1990, stored Rothenburg, preserved 2000 Aeroclub Peenemünde Airport
236 Black	MiG-21US	05685134	20-9-68	JG 2	24+07	Two-tone green camouflage, Q-mark. Withdrawn 10-1990, stored Rothenburg, to Aerotec 15-12-1994, later preserved Rothenburg Museum as EGAF '236 Black'
238 Black	MiG-21US	02685139	26-4-69	JG 1	24+08	Withdrawn 10-1990, stored Rothenburg, preserved 25-7-1994 Hermeskeil in two-tone green camouflage as '24 08'
240 Black	MiG-21US	03685139	6-1969	JG 1		Crashed 5-8-1988
242 Black	MiG-21US	04685139	6-1969	JG 1	24+09	Withdrawn 10-1990, stored Rothenburg, preserved 24-11-1994 Ankum Museum
246 Black	MiG-21US	05685139	6-1969	JG 1	24+10	Dark green/dark earth camouflage. Withdrawn 10-1990, stored Rothenburg, preserved 30-11-1994 Dessau as '24 10' without insignia, to Aeroclub 241, currently displayed Stendal Airport
248 Black	MiG-21US	06685139	10-5-69	JG 2	24+11	Withdrawn 10-1990, stored Rothenburg, preserved 20-7-1994 Seifertshofen Museum; to Baarlo, Holland 12-1999
250 Black	MiG-21US	01685148	13-6-70	JG 1	24+12	Silver overall. Withdrawn 10-1990, stored Rothenburg, preserved 12-7-1994 Seifertshofen Museum, noted 10-2001 at Leger dump store Bolsward, Holland

East German Air Force/Luftwaffe MiG-21UMs

EGAF serial	Version	C/n	In-service date	First unit	Luftwaffe serial	Comments
167 Black	MiG-21UM	02695174	11-4-73	JG 9	23+50	JG 8, JG 1, withdrawn 3-10-1990, scrapped Dresden 2-11-1992
168 Black	MiG-21UM	05695174	16-4-73	JG 9	23+51*	JG 8, JG 1, light grey overall, silver nose, later dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped Dresden 2-11-1992
169 Black	MiG-21UM	03695174	10-4-73	JG 9	23+52	JG 8, JG 1, withdrawn 3-10-1990, scrapped Dresden 2-11-1992
203 Black	MiG-21UM	01695163	5-1972	JG 3	23+84	TAFS 47, TAFS 87, dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped Dresden 14-10-1993
204 Black	MiG-21UM	02695163	11-2-72	JG 3	23+78	FAG 15, withdrawn 3-10-1990, preserved 15-3-1995 Bad Ischl, Austria
205 Black	MiG-21UM	03695163	10-2-72	JG 3	23+79	FAG 15, withdrawn 3-10-1990, front fuselage preserved Hermeskeil 24-11-1994
206 Black	MiG-21UM	04695163	25-2-72	JG 3	23+80	FAG 15, withdrawn 3-10-1990, preserved Tippmann Collection, Baschütz, 30-6-1994, reported 1997 at a Würzburg Museum
207 Black	MiG-21UM	10695162	7-1972	JG 3	23+81	TAFS 47, dark green/dark earth camouflage. Withdrawn 3-10-1990, preserved Aeropark Diepensee 10-11-1994, currently at private collection Sanner, Bensheim-Auerbach
210 Black	MiG-21UM	03695165	20-4-72	JG 9	23+53	JG 1, withdrawn 3-10-1990, scrapped Dresden 26-5-1993
211 Black	MiG-21UM	06695165	10-5-72	JG 9	23+70	JG 8, JG 7, JG 2, light grey overall, Q-mark. Withdrawn 3-10-1990, scrapped Dresden 2-9-1993
212 Black	MiG-21UM	05695168	11-1972	JG 3	23+59	Dark green/dark earth camouflage. Withdrawn 3-10-1990, to Police Sports Club Dessau 30-11-1994 as '23 59' without insignia, then to Dessau Museum, now on show at Freytag car towing centre, Staffelde
213 Black	MiG-21UM	07695168	2-1973	JG 3	23+85*	TAFS 87, green/tan camouflage. Withdrawn 3-10-1990, scrapped Dresden 29-9-1992
226 Black	MiG-21UM	516915071	8-5-74	JG 7	23+71	JG 2, withdrawn 3-10-1990, scrapped Dresden 2-11-1992
227 Black	MiG-21UM	516915076	14-5-74	JG 7	23+72	JG 2, withdrawn 3-10-1990, scrapped Dresden 26-5-1993
228 Black	MiG-21UM	516921051	6-8-74	JG 7	23+62	JG 8, withdrawn 3-10-1990, scrapped Dresden 11-11-1993
229 Black	MiG-21UM	516921056	9-10-74	JG 7	23+60	JG 3, withdrawn 3-10-1990, to Firma Reichhardt Gilching 26-8-1994
231 Black	MiG-21UM	516915011	31-5-74	JG 9	23+82*	JG 7, TAFS 47, withdrawn 3-10-1990, preserved Rimini, Italy, 20-6-1994 in overall tiger scheme
232 Black	MiG-21UM	516915001	23-3-74	JG 9	23+54	JG 1, withdrawn 3-10-1990, scrapped Dresden 25-10-1993
233 Black	MiG-21UM	516915006	31-5-74	JG 9	23+61	JG 3, two-tone green camouflage. Withdrawn 3-10-1990, preserved Finow 15-6-1994 as '23 61' without insignia
234 Black	MiG-21UM	516915021	3-4-74	JG 9	23+73	JG 8, JG 7, JG 2, withdrawn 3-10-1990, scrapped Dresden 21-10-1992
243 Black	MiG-21UM	516995031	9-1-78	JG 8	23+63	withdrawn 3-10-1990, scrapped 21-10-1992 Dresden
245 Black	MiG-21UM	516996036	11-1-78	JG 8	23+64	Light grey overall, silver nose, Q-mark. Withdrawn 3-10-1990, scrapped 17-3-1993 Dresden
249 Black	MiG-21UM	516995041	28-1-78	JG 8	23+65	Withdrawn 3-10-1990, scrapped 11-11-1993 Dresden
252 Black	MiG-21UM	09695155	12-4-71	JG 8	23+74	JG 7, JG 2, withdrawn 3-10-1990, scrapped Dresden 13-11-1992
253 Black	MiG-21UM	10695155	12-4-71	JG 8	23+75	JG 7, JG 2, withdrawn 3-10-1990, scrapped Dresden 29-6-1993
254 Black	MiG-21UM	01695156	21-4-71	JG 8	23+76	JG 7, JG 2, withdrawn 3-10-1990, scrapped Dresden 24-2-1993
255 Black	MiG-21UM	516995046	1-1978	JG 8		Crashed after cockpit fire 9-5-1984 near Eisenhüttenstadt (narrowly missing the Central LSK munitions dump at Schneeberg located nearby!)
256 Black	MiG-21UM	02695156	23-4-71	JG 8	23+77*	JG 7, JG 2, two-tone green camouflage. Withdrawn 3-10-1990, preserved Luftwaffe Museum 23-10-1994 with insignia taped over
257 Black	MiG-21UM	03695156	17-4-71	JG 8	23+55	JG 7, JG 1, silver overall. Withdrawn 3-10-1990, scrapped Dresden 26-5-1993
259 Black	MiG-21UM	04695156	29-4-71	JG 8	23+56	JG 1, withdrawn 3-10-1990, scrapped Dresden 29-6-1993
262 Black	MiG-21UM	05695156	5-5-71	JG 8	23+57	JG 1, withdrawn 3-10-1990, scrapped Dresden 11-10-1993
264 Black	MiG-21UM	06695156	11-5-71	JG 8	23+58	JG 1, light grey overall, silver nose. Withdrawn 3-10-1990, scrapped Dresden 7-9-1993
266 Black	MiG-21UM	07695156	8-1971	JG 3	23+83	TAFS 47, withdrawn 3-10-1990, preserved Bad Oeynhausen 21-6-1994
267 Black	MiG-21UM	516931001	9-1-75	JG 7	23+66	JG 8, withdrawn 3-10-1990, scrapped Dresden 9-8-1993
268 Black	MiG-21UM	516931041	30-1-75	JG 7	23+67	JG 8, dark green/dark earth camouflage. Withdrawn 3-10-1990, scrapped Dresden 12-1-1993
269 Black	MiG-21UM	516931046	3-1-75	JG 7	23+68	JG 8, withdrawn 3-10-1990, scrapped Dresden 17-3-1993
270 Black	MiG-21UM	516931051	5-2-75	JG 7	23+69	JG 8, withdrawn 3-10-1990, scrapped Dresden 29-6-1993

vertical and oblique cameras, while the CLA-87/II featured a Panasonic video camera/recorder.

All surviving aircraft then current with TAFS 47, TAFS 87 and JG 1 were withdrawn on 3rd October 1990 after the unification of Germany.

Visibly very similar to the MiG-21MF, the MiG-21M was distinguished by its lack of a periscope on the top of the cabin. When first delivered there were not only no periscopes on the top of the cockpit but also no blast plates

via RART

◀ **MiG-21PFM 22+04 (formerly '484 Red') was one of the few ex-EGAF MiG-21s to gain full Luftwaffe markings after German reunification on 3rd October 1990.**

immediately below the auxiliary engine blow-in doors. The plates were subsequently fitted to avoid blast from the cannon blowing the doors open and causing violent compressor stalls.

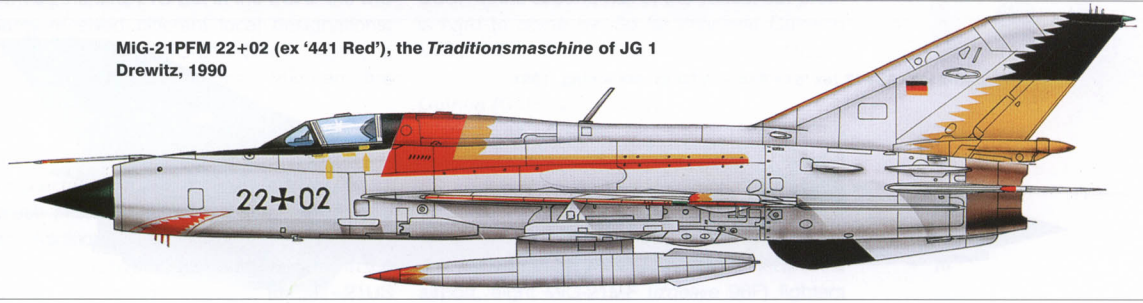
The MiG-21MF (*izdeliye* 96F) was the export equivalent of the MiG-21SM (*izdeliye* 95M, later changed to *izdeliye* 15), or from the point of view of the OKB a more powerful version of the MiG-21M. 50 aircraft powered by R13-300 turbojets were delivered to the EGAF from MMZ No. 30 'Znamya Truda' in Moscow. Deliveries began in February 1972, initially to JG 8 at Marxwalde, and then to JG 9 at Peenemünde, the order being completed in February 1974.

A second smaller order for 12 was placed in 1975, this time with *zavod* 21 in Gor'kiy, which had just started up a new production line for the MiG-21MF. As the factory was already building the MiG-21*bis* it made sense to incorporate its cockpit equipment into the new MiG-21MFs. To distinguish between the Moscow and Gor'kiy products the EGAF gave the latter the local

via RART

◀ **MiG-21PFM 22+02 received this striking farewell colour scheme with a sharkmouth earning it the name *Weißer Hai* ('White Shark'). Unfortunately the aircraft did not find a place in a museum, being scrapped on 13th November 1992.**

MiG-21PFM 22+02 (ex '441 Red'), the *Traditionsmaschine* of JG 1 Drewitz, 1990



Marcus Fulber

▲ **A less elaborate special scheme was worn by another JG 1 aircraft, MiG-21MF 23+15 (ex '510 Red'). The legend 'II JS' on the spine means II. *Jagdstaffel* (2nd Fighter Sqn).**

MiG-21M 22+59 (ex '493 Red') in standard ex-EGAF camouflage. This aircraft, too, was scrapped. ▼

designation **MiG-21MF-75**, the last two digits indicating 1975, the year its production began; such aircraft are marked * in the table on pages 560-561. Probably by chance, the serials of the twelve newcomers started at 765, whereas the 50 Moscow-built machines already delivered had non-consecutive serials between 427 Red and 699 Red.

Unlike the MiG-21M, the MiG-21MF was built with the small deflector plates below the auxiliary engine inlets and a periscope on the top of the canopy.

The final fighter variant was the MiG-21*bis* (*izdeliye* 75A and *izdeliye* 75B). It was given a new engine, the R25-300, to redress the criticism that the MiG-21 was inferior to its contemporaries at high speeds in low altitude flight. In addition, a slightly enlarged fuselage spine allowed 230 litres (51 Imp gal) extra internal fuel to be carried compared with MiG-21MF. The more powerful engine with its higher afterburning ratio was thirstier than its predecessor, the net result being a slightly shorter range, 1225 km (761 miles) compared with 1300 km (808 miles). However,

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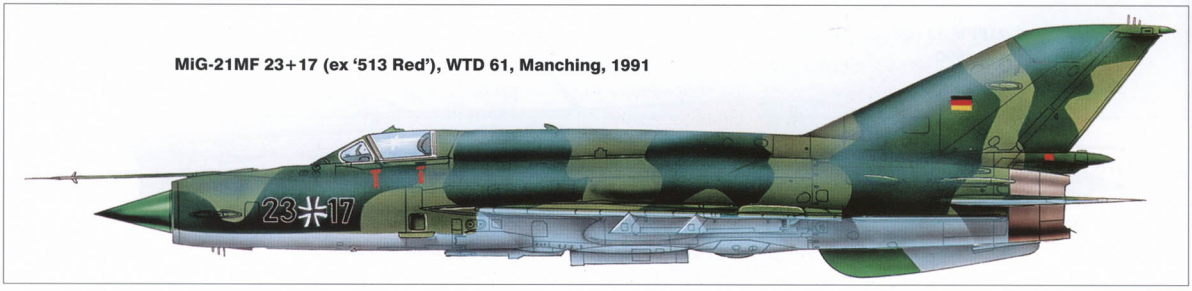


MiG-21MF 23+17 (ex '513 Red'), WTD 61, Manching, 1991

the fighter's performance at low and medium altitudes, at which all recent conflicts had been fought, was significantly improved. So was its manoeuvrability thanks to the new engine's diminished sensitivity to fluctuations in inlet airflow, an advantage that drastically reduced the likelihood of violent compressor stalls and flame-outs as the pilot threw the aircraft around in combat.

Forty-six MiG-21*bis* were delivered to the EGAF in two different subtypes, which received the following local designations:

- the **MiG-21*bis* Lazur'** (*izdeliye* 75A) had the Lazur' beacon/receiver to allow close control of interceptions by ground radar stations. 14 were delivered to JG 9 between April and October 1975.
- the **MiG-21*bis* SAU** (*izdeliye* 75B) lacked the Lazur' system but featured the SAU-23ESN automatic flight control system. 32 of this variant were delivered between May 1976 and October 1977.

All MiG-21*bis* were built by plant No. 21 in Gor'kiy and although survivors were officially written off on 3rd October 1990 many were retained and given Luftwaffe serial numbers; some underwent test programmes.

The MiG-21U (*izdeliye* 66) was the two-seat trainer version of the MiG-21F-13 and flew for the first time on 17th October 1960. Between 1962 and 1966 production of all trainer variants for the Soviet Air Force took place at *zavod* 31 in Tbilisi, Georgia. Export orders were fulfilled at MMZ No. 30 Znamya Truda between 1964 and 1968.

In mid-December 1964 two MiG-21Us were received by the EGAF, the first bulk deliveries following in April 1965. The first fourteen were to the original design (*izdeliye* 66-400) with the narrow vertical tail but thirty-one of the 1966-67 arrivals boasted a larger tail with the parabrake relocated under the rudder (*izdeliye* 66-600). Seventeen in total were sent to JAG 15, the remainder being distributed between JG 1, JG 3, JG 7, JG 8 and JG 9.

In Soviet Air Force service both types were known as the MiG-21U but in the EGAF the two variants received different local designations: **MiG-21U-400** and **MiG-21U-600** – again, a cross-breed of the service designation and the manufacturer's designation.

The blown flaps introduced on the MiG-21PFS were installed on a new version of the trainer together with the R13F2S-300 turbojet to teach pilots the necessary skills to operate them. Additionally, the more effective KM-1U ejection seat, replaced the SK model fitted in the MiG-21U. This variant, known as the MiG-21US (*izdeliye* 68A), was only built at the Tbilisi plant from 1966 to 1970.

Part way through the production run a periscope was installed to give the instructor in the rear cockpit a better view forward, an attribute particularly useful when landing.

Seventeen were delivered between July 1968 and June 1970 to JG 1, JG 2, JG 3, JG 7 and JG 9.

The MiG-21UM (*izdeliye* 69) was the final version of the trainer. MiG-21UMs were delivered first to JG 8 in 1970, continuing through 1971 before JG 3 and JG 9 were supplied in 1972-74 and JG 7 in 1974-75. A final delivery of three to JG 8 in 1978 completed the order.

Built only in Tbilisi, the trainer differed from the MiG-21US in having improved avionics and instrumentation. All, of course, had the recently introduced forward looking periscope but could be recognised by the dorsal blade aerial and the angle of attack vane on the port side of the nose.

In keeping with EGAF practice all trainers had black serials. Many East German MiG-21USs and MiG-21Us were later retrofitted with a dorsal blade aerial of a slightly different type with a horizontal bar on the top.

via Internet

▲ **'75 Red', a MiG-21MF of the Guinea-Bissau Air Force.**

Guinea-Bissau

On achieving independence on 24th September 1973, Portuguese Guinea became the Republic of Guinea-Bissau. Shortly afterwards the *Força Aérea da Guinea-Bissau* was formed. There are reports that its MiG-17Fs were replaced by at least six MiG-21MF (*izdeliye* 96F) fighters and one MiG-21UM (*izdeliye* 69) delivered from the USSR in the second half of the 1980s, but proof is hard to come by. So far only one Guinean MiG-21MF coded '75 Red' has been identified.

Guinea (Guinea-Conakry)

Guinea was a French colony until 1958 and the new Republic of Guinea was quick to create a modest air arm with assistance from the USSR. Known as *Force Aérienne de Guinée*, it received in 1986, as a *quid pro quo* for the use of maintenance facilities at Conakry-Gbessia airport, eight MiG-21MF (*izdeliye* 96F) fighters

and one MiG-21U type trainer. Some sources report the fighters as MiG-21PFMs; the fighter unit operating them has no number or name. Five were reported to be earmarked for restoration to airworthy condition by Russian engineers in 2001 and this must be true of at least one, as a MiG-21U variant crashed onto a TV station on 16th April 2007; fortunately there were no fatalities. There have been no reports of any serials carried.

Hungary

In June 1947 the post-war Hungarian Communist government formed the **Hungarian Air Force** (HuAF, or *Magyar Légierö*) with the blessing of the Allied Control Commission. Strictly speaking, the HuAF does not exist in its own right but is part of the Defence Forces.

Strong ties with the Soviet Union were officially created and ratified by the signing of the Warsaw Pact (WarPac) in May 1955. These ties were badly shaken by the 13-day uprising in 1956, which was swiftly suppressed by Soviet forces, but gradually Hungary settled down to be a loyal, if in some quarters reluctant, member of the Soviet bloc. Nonetheless, Hungary was the first Warsaw Pact country to receive the new MiG-21F-13.

Hungarian Air Force MiG-21F-13s undergoing maintenance. The intake cover of the nearest aircraft, '907 Red', appears to have been borrowed from a sister ship ('2319 Red'). ▼

Detlev Grass

Szucs Laszlo archive

▲ **A camouflaged Hungarian Air Force MiG-21PF, '1514 Red', operated by the 31 VE at Taszár.**

The HuAF had an establishment of three fighter regiments (*ézred*) of which two usually had two squadrons (*század*) and the third three squadrons.

The first twelve MiG-21F-13 (*izdeliye* 74) fighters arrived in 1961, followed by 68 more. They were intended to equip the regiments based first at Pápa, then Kecskemét and finally Taszár. All three regiments had been formed in November 1958 on the basis of the *Kiképzô ézred* (Training Centre):

47 *Vadászrepülö ézred* (Fighter Regiment, VE) at Pápa with two squadrons received their MiG-21F-13s in July 1961 but were temporarily at Taszár from July to September 1962 whilst their runway was repaired:

- 1. *Vadászrepülö Század* (Fighter Squadron, VS) 'Sámán' (Shaman);
- 2. VS 'Griff' (Griffon).

59 VE at Kecskemét also had two squadrons and began flying the MiG-21F-13 in 1962:

- 1. VS 'Puma' (Puma);
- 2. VS 'Dongó' (Wasp).

31 VE at Taszár had two squadrons and took delivery in 1962 and 1963:

- 1. VS 'Turul' (a Hungarian mythical bird like a phoenix);
- 2. VS 'Boszorkány' (Witch).

47 VE was always the first regiment to receive the latest version of the MiG-21, followed by 31 VE; their surplus older variants were then transferred to 59 VE.

The MiG-21F-13 remained in service until 1980.

HuAF serials were normally red and usually coincided with the last three or four digits of the construction number, with the occasional exception to confuse a potential enemy.

The first delivery of 12 out of the total of 24 of the improved MiG-21PF (*izdeliye* 76) arrived in 1964 and equipped 47 VE at Pápa whose surplus MiG-13F-13s were transferred to 31 VE at Taszár. In 1965 the final 12 MiG-21PFs were supplied to 31 VE. Any surplus MiG-21F-13 then went to 59 VE at Kecskemét.

Survivors were finally taken out of service on 21st December 1988.

Uniquely among WarPac countries, Hungary did not receive any MiG-21PFM or MiG-21M variants; the next version of the fighter to be ordered was the MiG-21MF (*izdeliye* 96). 50 of these were delivered between 1971 and 1974 and, as was customary, the new version served

Hungarian Air Force MiG-21F-13s

Serial	Version	C/n	In-service date	Comments
211	MiG-21F-13	741211	1961-3	Crashed 2-9-1971, pilot killed
212	MiG-21F-13	741212	1961-3	Sent to Syrian Air Force
213	MiG-21F-13	741213	1961-3	Crashed in snow storm 12-2-1964, pilot killed
214	MiG-21F-13	741214	1961-3	Sent to Syrian Air Force
215	MiG-21F-13	741215	1961-3	Sent to Syrian Air Force
216	MiG-21F-13	741216	1961-3	Sent to Syrian Air Force
217	MiG-21F-13	741217	1961-3	Crashed due to engine problems 12-8-1963, pilot killed
218	MiG-21F-13	741218	1961-3	Preserved *Ozigetvar Múzeum*, Alsónémedi, as '15'; reported scrapped 8-2007
219	MiG-21F-13	741219	1961-3	Crashed 10-7-1964, possibly misreported, see 221
221	MiG-21F-13	741221	1961-3	Crashed 10-7-1964, pilot ejected
222	MiG-21F-13	741222	1961-3	Sent to Syrian Air Force
223	MiG-21F-13	741223	1961-3	Written off 5-2-1964
224	MiG-21F-13	741224	1961-3	Stored Hungarian Aviation Museum, Szolnok
225	MiG-21F-13	741225	1961-3	Reserialled 1225 cf
301	MiG-21F-13	741301	1961-3	Preserved on plinth Kecskemét Museum as '25'
302	MiG-21F-13	741302	1961-3	Sent to Syrian Air Force
303	MiG-21F-13	741303	1961-3	Crashed 13-9-1966, pilot killed
304	MiG-21F-13	741304	1961-3	Crashed 10-5-1969, pilot ejected
305	MiG-21F-13	741305	1961-3	Noted preserved Budaörs 2005 with old-style insignia
306	MiG-21F-13	741306	1961-3	Sent to Syrian Air Force
307	MiG-21F-13	741307	1961-3	Crashed 23-6-1966, pilot killed
308	MiG-21F-13	741308	1961-3	Preserved *Ozigetvar Múzeum*, Alsónémedi, as '15'; reported scrapped 8-2007
309	MiG-21F-13	741309	1961-3	Written off 1-3-1966
311	MiG-21F-13	741311	1961-3	Sent to Syrian Air Force
312	MiG-21F-13	741312	1961-3	Crashed 9-9-1971, pilot killed
313	MiG-21F-13	741313	1961-3	Training airframe Tokol noted 2007
314	MiG-21F-13	741314	1961-3	Sent to Syrian Air Force
320	MiG-21F-13	741320	1961-3	Sent to Syrian Air Force
324	MiG-21F-13	741324	1961-3	Sent to Syrian Air Force
414	MiG-21F-13	741414	1961-3	Training airframe Szolnok noted 1991
801	MiG-21F-13	N74211801	1961-3	Preserved Taszár AB Museum, originally as '1975'
802	MiG-21F-13	N74211802	1961-3	Crashed 26-9-1970, pilot ejected
803	MiG-21F-13	N74211803	1961-3	Crashed 16-5-1968, pilot ejected
804	MiG-21F-13	N74211804	1961-3	Crashed 5-10-1967, pilot killed
805	MiG-21F-13	N74211805	1961-3	Noted 11-8-2007 on Kecskemét dump
806	MiG-21F-13	N74211806	1961-3	Preserved Pápa AB Heritage Park as '1976'
807	MiG-21F-13	N74211807	1961-3	Crashed 15-5-1975, pilot killed
808	MiG-21F-13	N74211808	1961-3	Training airframe Szolnok noted 2007
809	MiG-21F-13	N74211809	1961-3	Written off 16-5-1963
810	MiG-21F-13	N74211810	1961-3	Sent to Syrian Air Force
811	MiG-21F-13	N74211811	1961-3	Scrapped Szolnok
812	MiG-21F-13	N74211812	1961-3	Sent to Syrian Air Force
813	MiG-21F-13	N74211813	1961-3	Preserved Szolnok Museum with old-style insignia, noted 2007
814	MiG-21F-13	N74211814	1961-3	Stored Hungarian Aviation Museum, Szolnok, with old-style insignia, noted 2007
815	MiG-21F-13	N74211815	1961-3	Crashed 21-12-1967, pilot killed
816	MiG-21F-13	N74211816	1961-3	Training airframe Szolnok noted 2006
817	MiG-21F-13	N74211817	1961-3	Scrapped Taszár
818	MiG-21F-13	N74211818	1961-3	Caught fire taking off 31-8-1967, pilot escaped
819	MiG-21F-13	N74211819	1961-3	Stored Hungarian Aviation Museum, Szolnok, noted 2007
820	MiG-21F-13	N74211820	1961-3	Scrapped Szolnok
821	MiG-21F-13	N74211821	1961-3	Scrapped Szolnok
822	MiG-21F-13	N74211822	1961-3	Preserved Hungarian Aviation Museum, Szolnok, noted 2007
823	MiG-21F-13	N74211823	1961-3	Scrapped Kenyeri
824	MiG-21F-13	N74211824	1961-3	Training airframe Szolnok, noted 2007

825	MiG-21F-13	N74211825	1961-3	Noted preserved Tapioszesko, noted 2007
901	MiG-21F-13	N74211901	1961-3	Crashed 17-7-1969, pilot ejected
902	MiG-21F-13	N74211902	1961-3	Crashed 3-10-1972, pilot ejected
903	MiG-21F-13	N74211903	1961-3	Scrapped Kenyeri
904	MiG-21F-13	N74211904	1961-3	Crashed 12-8-1963 due to engine problems, pilot ejected
905	MiG-21F-13	N74211905	1961-3	Preserved Seifertshofen as Hungarian AF '1981', noted 2007
906	MiG-21F-13	N74211906	1961-3	Sent to Syrian Air Force
907	MiG-21F-13	N74211907	1961-3	Preserved József Pintér Museum, Kecel, as '1977', noted 2007. Photo exists of MiG-21F-13 '907 Red' with air intake cover bearing the serial '907' and the c/n 2319, see this c/n!
908	MiG-21F-13	N74211908	1961-3	Crashed 31-7-1969, pilot ejected
909	MiG-21F-13	N74211909	1961-3	Training airframe Kecskemét noted 2001 as '1977/1978'
910	MiG-21F-13	N74211910	1961-3	Crashed 11-5-1967 after hydraulics failure, pilot killed
911	MiG-21F-13	N74211911	1961-3	Stored Hungarian Aviation Museum, Szolnok
912	MiG-21F-13	N74211912	1961-3	Crashed 14-7-1964, pilot killed
913	MiG-21F-13	N74211913	1961-3	Noted on dump at Pápa 2001
914	MiG-21F-13	N74211914	1961-3	Scrapped Szolnok
915	MiG-21F-13	N74211915	1961-3	Noted stored Kecskemét 11-8-2007
1225	MiG-21F-13	N74211225	1961-3	Delivered as 225, later renumbered 1225. Now preserved Internationales Luftfahrtmuseum Manfred Pflumm, Villingen-Schwenningen, Germany, as Hungarian AF '1981'
2219	MiG-21F-13	N74212219	1961-3	Crashed 20-5-1966, pilot ejected
2221	MiG-21F-13	N74212221	1961-3	Noted stored Szolnok 2005
2222	MiG-21F-13	N74212222	1961-3	Crashed 18-8-1967, pilot killed
2311	MiG-21F-13	N74212311	1961-3	Stored Hungarian Aviation Museum, Szolnok
2312	MiG-21F-13	N74212312	1961-3	Crashed 2-5-1966, pilot ejected
2313	MiG-21F-13	N74212313	1961-3	Sold to USA 1988, noted stored AMARC, Davis-Monthan AFB, Tucson, AZ 2005
2314	MiG-21F-13	N74212314	1961-3	Crashed 2-5-1966, pilot killed
2315	MiG-21F-13	N74212315	1961-3	Sent to Syrian Air Force
2316	MiG-21F-13	N74212316	1961-3	Stored Hungarian Aviation Museum, Szolnok
2317	MiG-21F-13	N74212317	1961-3	Crashed 1-3-1968, pilot killed
2318	MiG-21F-13	N74212318	1961-3	Preserved Republic of China Air Force Academy, Kangshan, Taiwan
2319	MiG-21F-13	N74212319	1961-3	Noted 2000 preserved Alsónémedi Museum as '1981' but reported scrapped 8-2007
2320	MiG-21F-13	N74212320	1961-3	Crashed 5-6-1969, pilot ejected

first with the 47 VE at Pápa, whose remaining MiG-21F-13s went to 59 VE at Kecskemét.

Survivors were not finally withdrawn from service until December 2006.

The last and most effective fighter variant was the MiG-21*bis*, of which 62 were supplied. For a change, 31 VE at Taszár was given the first delivery in 1975 and these were MiG-21*bis* (*izdeliye* 75A) interceptors with GCI command link. 47 VE received its initial delivery in 1977 when both regiments were given MiG-21*bis* (*izdeliye* 75B) tactical fighters. The surplus

via Internet

'409 Red', another camouflaged MiG-21PF, operated by 47 VE in communist-era star-type insignia. Originally the Hungarian MiG-21PFs were silver or grey overall.

Hungarian Air Force MiG-21PFs					
Serial	Version	C/n	Delivery date	First unit	Comments
406	MiG-21PF	760406	1964	47. VE	Damaged 7-4-1981 noted 2007 stored Szolnok
407	MiG-21PF	760407	1964	47. VE	Crashed 31-1-1968, pilot killed
408	MiG-21PF	760408	1964	47. VE	Preserved USAF Museum, Wright-Patterson AFB, Dayton, OH, USA
409	MiG-21PF	760409	1964	47. VE	Dark green/tan camouflage. Stored Kecskemét; later preserved Taszár AB Museum, originally as '1989', but subsequently scrapped
501	MiG-21PF	760501	1964	47. VE	Overall silver finish. Preserved Imperial War Museum, Duxford, England in overall light grey finish
502	MiG-21PF	760502	1964	47. VE	Crashed 25-3-1986, pilot ejected
503	MiG-21PF	760503	1964	47. VE	Overall silver finish. Preserved Farnborough, England
504	MiG-21PF	760504	1964	47. VE	Stored Kecskemét but subsequently scrapped
505	MiG-21PF	760505	1964	47. VE	Preserved Taszár AB Museum, originally as '1989'
506	MiG-21PF	760506	1964	47. VE	Sold as G-BRAN, then as N316DM
507	MiG-21PF	760507	1964	47. VE	Preserved in USMC Museum, MCAS Quantico (VA), then Pima County Air Museum (AZ), currently Mesa (AZ), USA
508	MiG-21PF	760508	1964	47. VE	Stored Kecskemét but subsequently scrapped
509	MiG-21PF	760509	1965	31. VE	Stored Kecskemét but subsequently scrapped
10	MiG-21PF	760510	1965	31. VE	Stored Kecskemét but subsequently scrapped
1511	MiG-21PF	761511	1965	31. VE	Written off 17-10-1968, used as ground training airframe Szolnok
1512	MiG-21PF	761512	1965	31. VE	Preserved Hungarian Aviation Museum, Szolnok
1513	MiG-21PF	761513	1965	31. VE	Crashed 2-4-1968, pilot ejected
1514	MiG-21PF	761514	1965	31. VE	Dark green/tan camouflage. Front fuselage preserved *Közlekedési Múzeum* (Transport Museum), Budapest, as '14'
1515	MiG-21PF	761515	1965	31. VE	Crashed 10-4-1980, pilot killed
1601	MiG-21PF	761601	1965	31. VE	Stored Kecskemét but subsequently scrapped
602	MiG-21PF	761602	1965	31. VE	Stored Kecskemét but subsequently scrapped
1603	MiG-21PF	761603	1965	31. VE	Sold as G-BRAO, then N621DM and currently N21MG at Oshkosh, WI, USA
1604	MiG-21PF	761604	1965	31. VE	Crashed 23-4-1971, pilot ejected
1605	MiG-21PF	761605	1965	31. VE	Stored Kecskemét but subsequently scrapped

MiG-21PFs and MiG-21MFs were redeployed to 59 VE. However, poetic justice was done when the latter unit was selected as the HuAF's first regiment to receive the new-generation MiG-29.

The first MiG-21U two-seat trainers arrived in Kecskemét for 59 HRE in 1963.

In all, 18 MiG-21U trainers (twelve narrow-tailed *izdeliye* 66-400s and six broad-tailed *izdeliye* 66-600s) and 27 MiG-21UMs (*izdeliye* 69A) were reportedly delivered to the HuAF, but 47 aircraft are listed on page 577 (including 28 MiG-21UMs). The latter were delivered between 1971 and 1986. The survivors were withdrawn from service in 2001.

In 1971 there was a reorganisation of Hungary's military aviation assets in which two totally separate commands similar to the Soviet PVO and VVS were formed:

- *Országos Légvédelmi Parancsokság* (the National Air Defence Command) with two interceptor regiments and 3 SAM regiments;
- *Csapatrepülö Parancsokság* (the Troop Air Command) with one fighter-bomber regiment (reduced in 1980 to one squadron of Sukhoi Su-22M-3s).

However, on 31st March 1991 after the dissolution of the USSR and the Warsaw Pact the two commands came together under the control of the *Magyar Honvédség Repülö* (Air Defence Group) and the National Air Defence Command was renamed *Légvédelmi és Repülö Parancsokság* (Air Defence and Aviation Command). The existing Fighter Regiments were redesignated Tactical Fighter Regiments.

Based at Kecskemét was the *'Deszö Szentgyörgy' Harcászati Repülö ézred* (Tactical Fighter Regiment, HRE) – the former 59th HRE, now named after the highest-scoring Hungarian fighter pilot with 33 victories in World War 2). The regiment had two squadrons:

A freshly refurbished MiG-21*bis* (*izdeliye* 75B) wearing the HAF's current chevron insignia.
▼

via Internet

Hungarian Air Force MiG-21MFs

Serial	Version	C/n	In-service date	Comments
4403	MiG-21MF	964403	1971-4	Dark green/tan camouflage. Noted stored Pápa 2007
4404	MiG-21MF	964404	1971-4	Noted stored Pápa 2007
4405	MiG-21MF	964405	1971-4	Noted stored Pápa 2007
4406	MiG-21MF	964406	1971-4	Preserved Graz-Thalerhof, Austria
4407	MiG-21MF	964407	1971-4	Damaged 13-7-1977, preserved Lajos Kossuth Museum, Budapest
4408	MiG-21MF	964408	1971-4	Noted stored Pápa 2007
4409	MiG-21MF	964409	1971-4	Noted stored Pápa 2007
4602	MiG-21MF	964602	1971-4	Written off 27-6-1978; another report suggests collided with MiG-21MF '9314 Red' 5-6-1984 and crashed, pilot killed
4603	MiG-21MF	964603	1971-4	Scrapped Kecskemét
4604	MiG-21MF	964604	1971-4	Crashed 27-6-1978, pilot killed
4605	MiG-21MF	964605	1971-4	Stored Szolnok Technical School
4606	MiG-21MF	964606	1971-4	Stored Szolnok Technical School
4607	MiG-21MF	964607	1971-4	Scrapped Kecskemét
4608	MiG-21MF	964608	1971-4	Scrapped Kecskemét
8108	MiG-21MF	968108	1971-4	Scrapped Kecskemét
8109	MiG-21MF	968109	1971-4	Scrapped Kecskemét
8110	MiG-21MF	968110	1971-4	Stored Kecskemét 1999 but subsequently scrapped
8111	MiG-21MF	968111	1971-4	Dark green/dark earth camouflage. Scrapped Kecskemét
8112	MiG-21MF	968112	1971-4	Crashed 18-12-1975, pilot ejected
8113	MiG-21MF	968113	1971-4	Scrapped Kecskemét
8114	MiG-21MF	968114	1971-4	Dark green/tan camouflage. Noted stored Pápa 2007
8115	MiG-21MF	968115	1971-4	Scrapped Kecskemét
8201	MiG-21MF	968201	1971-4	Dark green/dark earth camouflage. Noted stored Pápa 2007
8202	MiG-21MF	968202	1971-4	Dark green/tan camouflage. Preserved József Pintér Museum, Kecel
8203	MiG-21MF	968203	1971-4	Scrapped Kecskemét
8204	MiG-21MF	968204	1971-4	Noted stored Pápa 2007
9306	MiG-21MF	969306	1971-4	Stored Szolnok Museum
9307	MiG-21MF	969307	1971-4	Dark green/tan camouflage. Noted stored Pápa 2007
9308	MiG-21MF	969308	1971-4	Preserved Komutanligi Museum, Turkey
9309	MiG-21MF	969309	1971-4	Dark green/tan camouflage. Preserved Szolnok Museum
9310	MiG-21MF	969310	1971-4	Scrapped Kecskemét
9311	MiG-21MF	969311	1971-4	Dark green/tan camouflage. Preserved József Pintér Museum, Kecel, in new insignia with RS-2-US AAMs on outer pylons (!?)
9312	MiG-21MF	969312	1971-4	Noted stored Kecskemét 2000; by 2005 stored Belgian Military Radio Museum, Lanaken
9313	MiG-21MF	969313	1971-4	Crashed 18-1-1977
9314	MiG-21MF	969314	1971-4	Collided with MiG-21MF '4602 Red' 5-6-1984 and crashed, pilot ejected
9315	MiG-21MF	969315	1971-4	Noted stored Pápa 2007
9507	MiG-21MF	969507	1971-4	Dark green/tan camouflage. Noted stored Pápa 2007
9508	MiG-21MF	969508	1971-4	Written off 18-1-1977
9509	MiG-21MF	969509	1971-4	Noted stored Kecskemét 2000 but subsequently scrapped
9510	MiG-21MF	969510	1971-4	Noted stored Pápa 2007
9511	MiG-21MF	969511	1971-4	Noted stored Kecskemét 2000 but subsequently scrapped
9512	MiG-21MF	969512	1971-4	Preserved Szolnok Museum
9513	MiG-21MF	969513	1971-4	Noted stored Kecskemét 2000; by 2005 stored Belgian Military Radio Museum, Lanaken
9514	MiG-21MF	969514	1971-4	Noted stored Kecskemét 2000 but subsequently scrapped
9515	MiG-21MF	969515	1971-4	Noted stored Pápa 2007
9601	MiG-21MF	969601	1971-4	Crashed 25-7-1985, pilot ejected
9602	MiG-21MF	969602	1971-4	Noted stored Kecskemét 2000 but subsequently scrapped
9603	MiG-21MF	969603	1971-4	Noted stored Pápa 2007
9604	MiG-21MF	969604	1971-4	Dark green/tan camouflage. Noted stored Pápa 2004
9605	MiG-21MF	969605	1971-4	Crashed 12-9-1991, pilot killed
9606	MiG-21MF	969606	1971-4	47 HRE. Dark green/tan camouflage, '47' on tail. Noted stored Pápa 2007

Hungarian Air Force MiG-21*bis* fighters

Serial	Version	C/n	First unit	Comments
41	MiG-21*bis* (izd. 75B)	75077711	47 HRE	Stored Pápa 2007
42	MiG-21*bis* (izd. 75B)	75077729	47 HRE	Dark green/tan camouflage; shows signs of reserialling. Stored Pápa 2007
43	MiG-21*bis* (izd. 75B)	75077754	47 HRE	Stored Pápa 2007
44	MiG-21*bis* (izd. 75B)	75077798		Crashed 12-4-1984, pilot ejected
45	MiG-21*bis* (izd. 75B)	75077800		Crashed 19-8-1988, pilot killed
46	MiG-21*bis* (izd. 75B)	75077805	47 HRE	Dark green/tan camouflage, '47' on tail. Stored Pápa 2007
47	MiG-21*bis* (izd. 75B)	75077813	47 HRE	Stored Pápa 2007
48	MiG-21*bis* (izd. 75B)	75081501	47 HRE	Stored Pápa 2007
49	MiG-21*bis* (izd. 75B)	75081510	47 HRE	Dark green/tan camouflage, '47' on tail. Stored Pápa 2007
50	MiG-21*bis* (izd. 75B)	75081614		Crashed 22-8-1991, pilot killed
51	MiG-21*bis* (izd. 75B)	75081637	47 HRE	Stored Pápa 2007
52	MiG-21*bis* (izd. 75B)	75081645		Crashed 7-7-1981, pilot ejected
1844	MiG-21*bis* (izd. 75B)	75061844	47 HRE	Dark green/tan camouflage. Stored Pápa 2007
1867	MiG-21*bis* (izd. 75B)	75061867	47 HRE	Stored Pápa 2007
1874	MiG-21*bis* (izd. 75B)	75061874	47 HRE	Dark green/tan camouflage, 'Sky Hussars' display team. Stored Pápa 2006; to Niederalteich 2007
1889	MiG-21*bis* (izd. 75B)	75061889	47 HRE	Stored Pápa 2007
1900	MiG-21*bis* (izd. 75B)	75061900	47 HRE	Dark green/tan camouflage. Stored Pápa 2007
1904	MiG-21*bis* (izd. 75B)	75061904		'Sky Hussars' display team, overall ochre c/s with sharkmouth. Preserved Taszár AB Museum, noted 2003
1953	MiG-21*bis* (izd. 75B)	75061953		Dark green/tan camouflage. Preserved József Pintér Museum, Kecel, with new-style insignia, noted 2007
1968	MiG-21*bis* (izd. 75B)	75061968	47 HRE	Dark green/tan camouflage. Stored Pápa 2007
2001	MiG-21*bis* (izd. 75B)	75062001		Crashed 10-6-1988, pilot ejected
2021	MiG-21*bis* (izd. 75B)	75062021	47 HRE	Dark green/tan camouflage. Stored Pápa 2007
2098	MiG-21*bis* (izd. 75B)	75062098	47 HRE	Dark green/tan camouflage. Stored Pápa 2007
2105	MiG-21*bis* (izd. 75B)	75062105	47 HRE	Dark green/tan camouflage. Stored Pápa 2007
3537	MiG-21*bis* (izd. 75A)	75033537		Damaged 16-5-1984 and written off, now at Technical School, stored for Hungarian Aviation Museum, Szolnok
3547	MiG-21*bis* (izd. 75A)	75033547		Crashed 14-3-1989 after collision with MiG-21bis '3931 Red', pilot ejected
3732	MiG-21*bis* (izd. 75A)	75033732		Stored Hungarian Aviation Museum, Szolnok, noted 2005
3745	MiG-21*bis* (izd. 75A)	75033745		Noted Szolnok 8-2007 as instructional airfame
3931	MiG-21*bis* (izd. 75A)	75033931		Crashed 14-3-1989 after collision with MiG-21bis '3547 Red', pilot ejected
3945	MiG-21*bis* (izd. 75A)	75033945		Preserved Hungarian Aviation Museum, Szolnok
3955	MiG-21*bis* (izd. 75A)	75033955		Noted Kecskemét dump 1995 but subsequently scrapped
3964	MiG-21*bis* (izd. 75A)	75033964		Preserved NAS Fallon Heritage Park, NV, USA
3987	MiG-21*bis* (izd. 75A)	75033987		Crashed 9-6-1981, pilot ejected
4009	MiG-21*bis* (izd. 75A)	75034009	31 HRE	
4025	MiG-21*bis* (izd. 75A)	75034025	47 HRE	Stored Pápa 2007
4029	MiG-21*bis* (izd. 75A)	75034029		Crashed 27-8-1981, pilot ejected
4058	MiG-21*bis* (izd. 75A)	75034058	47 HRE	Stored Pápa 2007
4097	MiG-21*bis* (izd. 75A)	75034097		Reported crashed 7-7-1983, pilot ejected
4112	MiG-21*bis* (izd. 75A)	75034112		Noted Kecskemét dump 1995 but subsequently scrapped
4133	MiG-21*bis* (izd. 75A)	75034133		Crashed 3-8-1976, pilot ejected
5321	MiG-21*bis* (izd. 75A)	75035321		Crashed 1-3-1984, pilot killed
5531	MiG-21*bis* (izd. 75A)	75035531	47 HRE	Dark green/tan camouflage, '47' on tail. Stored Pápa 2007
5540	MiG-21*bis* (izd. 75A)	75035540	47 HRE	Dark green/tan camouflage; 'Sky Hussars' display team. Stored Pápa 2007
5705	MiG-21*bis* (izd. 75A)	75035705		Crashed 13-12-1977, pilot ejected
5721	MiG-21*bis* (izd. 75A)	75035721		Dark green/tan camouflage. Preserved Taszár AB Museum, MiG-21bis, noted 2003
5809	MiG-21*bis* (izd. 75A)	75035809		Crashed 29-6-1990, pilot ejected
5822	MiG-21*bis* (izd. 75A)	75035822		Dark green/tan camouflage, 'Sky Hussars' display team. Crashed 18-9-1996 due to hydraulics failure, pilot ejected
6007	MiG-21*bis* (izd. 75A)	75036007	47 HRE	Stored Pápa 2007
6009	MiG-21*bis* (izd. 75A)	75036009	47 HRE	Dark green/tan camouflage. Stored Pápa 2007
6021	MiG-21*bis* (izd. 75A)	75036021	47 HRE	Dark green/tan camouflage, '47' on tail. Stored Pápa 2007
6115	MiG-21*bis* (izd. 75A)	75036115	47 HRE	Dark green/tan camouflage, '47' on tail. Wore anniversary colours in 2000 with Hungarian flag stripe and the legend '1950-2000'. Stored Pápa 2007
6145	MiG-21*bis* (izd. 75A)	75046145	47 HRE	Dark green/tan camouflage, signs of reserialling. Stored Pápa 2007

6207	MiG-21bis (izd. 75A)	75046207		Crashed 7-7-1983, pilot ejected
6224	MiG-21bis (izd. 75A)	75046224		Damaged beyond repair 11-11-1980
6253	MiG-21bis (izd. 75A)	75046253	47 HRE	Dark green/tan/brown camouflage. Stored Pápa 2007
6264	MiG-21bis (izd. 75A)	75047504	31 HRE	Dark green/tan camouflage. Damaged 25-4 1996, stored Pápa 2007
6305	MiG-21bis (izd. 75A)	75046305	47 HRE	Dark green/tan camouflage. Stored Pápa 2004; to Nahyatád 2007
6327	MiG-21bis (izd. 75A)	75046327	47 HRE	Stored Pápa 2007
6384	MiG-21bis (izd. 75A)	75046384	47 HRE	Dark green/tan camouflage. Stored Pápa 2007
9099	MiG-21bis (izd. 75A)	75049099	47 HRE	Stored Pápa 2004, then San Diego Museum, CA, USA
9125	MiG-21bis (izd. 75A)	75049125	47 HRE	Stored Pápa 2007
9178	MiG-21bis (izd. 75A)	75049178	47 HRE	Dark green/tan camouflage. Stored Pápa 2007
9207	MiG-21bis (izd. 75A)	75049207		Crashed 17-10-1981, pilot believed killed

▲
The badges of the 'Pápa' Tactical Fighter Wing (top) and its 2 Sqn.

• 1 VS 'Puma' with ten MiG-21MFs and two MiG-21UMs;

• 2 VS 'Dóngó' with ten MiG-21*bis* fighters and two MiG-21UMs.

Based at Pápa was the *Harcászati Repülö ézred 'Pápa'* (former 47th HRE, now named after the town at which it had been based for many years), likewise with two squadrons:

• 1 VS 'Sámán' with nine MiG-23MFs and two MiG-23UBs;

• 2 VS 'Griff' with ten MiG-21*bis* fighters and two MiG-21UMs.

Marcus Fulber

via RART

▲▲
MiG-21UM '905 Red' carries the badges of the 'Pápa' TFW (ex 47 HRE) on the tail, 1 VS 'Sámán' on the nose and an ad for Fortis Swiss watches!

▲
MiG-21*bis* (*izdeliye* 75B) '6145 Red', a 47 HRE aircraft, was the last of the type delivered to the Hungarian Air Force.

Hungarian Air Force MiG-21U trainers

Serial	Version	C/n	In-service date	First unit	Comments
0820	MiG-21U (*izd.* 66-400)	660820	1963		Sold to India 1986-7 as U670
919	MiG-21U (*izd.* 66-400)	660919	1963		Sold to India 1986-7 as U3001
1319	MiG-21U (*izd.* 66-400)	661319	1963		Ground instructional airframe Tököl AB, noted 2007 stored Hungarian Aviation Museum, Szolnok
1320	MiG-21U (*izd.* 66-400)	661320	1963		Stored Ozigetvar Múzeum, Alsónémedi, noted 2005
1418	MiG-21U (*izd.* 66-400)	661418	1964		Preserved József Pintér Museum, Kecel
1419	MiG-21U (*izd.* 66-400)	661419	1964		Sold to India 1986-7 as U3002
1420	MiG-21U (*izd.* 66-400)	661420	1964		Sold to India 1986-7 as U671
1516	MiG-21U (*izd.* 66-400)	661516	1964	59. HRE	Crashed 6-4-1972, crew killed
1517	MiG-21U (*izd.* 66-400)	661517	1964		Preserved Miskolc, later scrapped
1720	MiG-21U (*izd.* 66-400)	661720	1965		Sold to India 1986-7 as U672
1816	MiG-21U (*izd.* 66-400)	661816	1965		Sold to India 1986-7 as U673
1817	MiG-21U (*izd.* 66-400)	661817	1965		Sold to India 1986-7 as U674
4020	MiG-21U (*izd.* 66-600)	664020	1966	47. HRE	Crashed 9-2-1962, crew killed
4116	MiG-21U (*izd.* 66-600)	664116	1966		Crashed 8-3-1969, crew ejected
4117	MiG-21U (*izd.* 66-600)	664117	1966		Sold to India as U3003
4418	MiG-21U (*izd.* 66-600)	664418	1967		Sold to USA as N315RF
4419	MiG-21U (*izd.* 66-600)	664419	1967		Overall silver finish. Preserved Hungarian Aviation Museum, Szolnok, with old-style insignia
4420	MiG-21U (*izd.* 66-600)	664420	1967		Sold to India 1986-7 as U3004

Hungarian Air Force MiG-21UMs

Serial	Version	C/n	In-service date	First unit	Comments
16	MiG-21UM	516999201	1979		Reserialled '19' in 7-1981, some sources suggest crashed 1981
17	MiG-21UM	516999202	1979	47 HRE	Noted 2007 stored Pápa
18	MiG-21UM	516999203	1979	47 HRE	Dark green/tan camouflage, '47' on tail. Noted 2006 stored Pápa
19	MiG-21UM	516999201	1979	47 HRE	Dark green/tan camouflage. Ex '16', reserialled 7-1981, noted 2007 stored Pápa
35	MiG-21UM	516999209	1979		C/n also reported as 516999208. Crashed 6-5-1988, crew ejected
53	MiG-21UM	516999204	1979	47 HRE	Two-tone green camouflage; shows signs of reserialling. Noted 2007 stored Pápa
54	MiG-21UM	516999299	1979	47 HRE	Ex-'507' No. 2? (intake cover shows '507' but is definitely too small for MiG-21PF c/n 760507). Two-tone green camouflage. Noted 2007 stored Pápa
55	MiG-21UM	516999301	1979	47 HRE	Three-tone green/brown camouflage. Noted 2007 stored Pápa
086	MiG-21UM	516955086	1976	47 HRE	Three-tone green/brown camouflage. Noted 2007 stored Pápa
091	MiG-21UM	516955091	1976	47 HRE	Two-tone green camouflage, '47' on tail. Noted 2006 stored Pápa
096	MiG-21UM	516955096	1976	47 HRE	Dark green/tan camouflage, '47' on tail. Noted 2006 stored Pápa
0158	MiG-21UM	01695158	1971	47 HRE	Three-tone green/brown camouflage. Preserved József Pintér Museum, Kecel, noted 2007
0258	MiG-21UM	02695158	1971	47 HRE	Crashed 16-10-1984 after ingesting goose on landing approach, one crew member survived by ejecting
0265	MiG-21UM	02695165	1971	47 HRE	Crashed 17-7-1986 on take off at Kecskemét, crew killed. Some sources suggest the c/n was 02695168
0358	MiG-21UM	03695158	1973	31 HRE	Crashed 28-1-1983, crew killed
0465	MiG-21UM	04695165	1973	31 HRE	Three-tone green/brown camouflage. Noted Szolnok 8-2007 as instructional airfame
0565	MiG-21UM	05695165	1973	31 HRE	Preserved St Isidorushoeve, Holland noted 2002
904	MiG-21UM	516999504	1986	47 HRE	Noted 2007 stored Pápa
905	MiG-21UM	516999505	1986	47 HRE	Dark green/tan camouflage, '47' on tail. Noted 2007 stored Pápa
906	MiG-21UM	516999506	1986	47 HRE	Noted 2007 stored Pápa
907	MiG-21UM	516999507	1986	47 HRE	Noted 2007 stored Pápa
3031	MiG-21UM	516903031	1974	47 HRE	Crashed 1-6-1994, trainee killed, instructor ejected safely
3036	MiG-21UM	516903036	1974	47 HRE	Preserved Best Museum, Holland
3041	MiG-21UM	516903041	1974	47 HRE	Two-tone green camouflage. Preserved Hungarian Aviation Museum, Szolnok, with new-style insignia, noted 2007
5081	MiG-21UM	516915081	1974	47 HRE	Dark green/tan camouflage. Noted 2007 stored Pápa
5086	MiG-21UM	516915086	1974	47 HRE	Crashed 2-10-1979, crew ejected
5091	MiG-21UM	516915091	1974	47 HRE	Noted 2007 stored Pápa
7011	MiG-21UM	516917011	1974	47 HRE	Three-tone green camouflage. Noted 2007 stored Pápa

MiG-21*bis* (*izdeliye* 75B) '1904 Red', 'Sky Hussars' display team, HRE 'Kapos'
Note that each drop tank has its own sharkmouth

MiG-21*bis* (*izdeliye* 75B) '6115 Red', 'HRE 'Pápa'/2 VS 'Griff' in anniversary colours

MiG-21UM '7011 Red', 47 HRE, Pápa AB, 2007

Based at Taszár was the *Harcászati Repülö ézred 'Kapos'* (former 31st HRE, now named after the region in which it had been based) with three squadrons:

- 1 VS 'Boszorkány' with ten MiG-21*bis* fighters and two MiG-21UMs;
- 2 VS 'Turul' with ten MiG-21*bis* fighters and two MiG-21UMs;
- 3 *Felderito Repülö Század* (Reconnaissance Air Squadron) 'Fükészdarázs' (Bumble Bee) with ten Su-22M-3Rs and a Su-22UM-3 trainer.

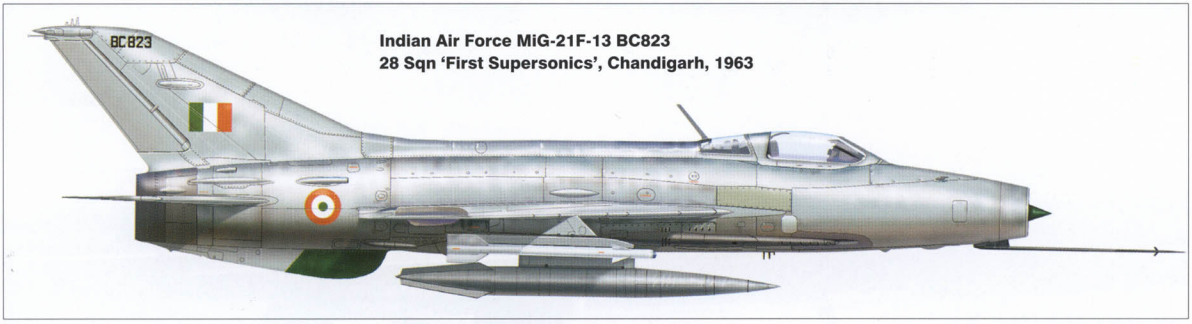
The HuAF (specifically, HRE 'Kapos') had a display team called Sky Hussars and flying four MiG-21*bis*. The team's solo aircraft wore an overall ochre colour scheme with a sharkmouth.

By the time the MiG-21 was finally withdrawn from service towards the end of 2000 there were 12 MiG-21*bis* with VS 'Sámán' in the air defence role and VS 'Griff' had ten MiG-21UMs as ground attack aircraft until they were ceremonially retired on 24th August 2000.

India

The **Indian Air Force** (IAF, or *Bharatiya Vayu Sena*) was formed from the Royal Indian Air Force (RIAF) in January 1950 after India became an independent Republic within the British Commonwealth, the RIAF itself having been formed on 8th October 1932. Now the world's fourth biggest air force, the IAF was the largest user of the MiG-21 family outside the USSR.

The MiG-21 was the first combat aircraft of non-Western origin in the IAF inventory and its choice marked a watershed in the procurement of aircraft for the IAF. An agreement concluded in August 1962 provided for the Indian purchase of twelve MiG-21s and Soviet technical assistance in establishing licence production of the type in India. A group of eight IAF pilots arrived at Frunze, the capital of the Kyrghyz SSR (now Bishkek), on 9th October 1962 to take a three-month conversion training course at the nearby Loogovaya AB, transitioning to the MiG-21 via the UTI MiG-15 and MiG-17.



Indian Air Force MiG-21F-13 BC823
28 Sqn 'First Supersonics', Chandigarh, 1963

Indian Air Force MiG-21F-13s & MiG-21PFs

Serial	Version	Delivery	Unit	Comments
BC816	MiG-21F-13	1963	28 Sqn	
BC817	MiG-21F-13	1963	28 Sqn	
BC818	MiG-21F-13	1963	28 Sqn	
BC819	MiG-21F-13	1963	28 Sqn	
BC820	MiG-21F-13	1963	28 Sqn	
BC821	MiG-21F-13	1963	28 Sqn	
BC822	MiG-21F-13	1964	28 Sqn	
BC823	MiG-21F-13	1964	28 Sqn	
BC824	MiG-21F-13	1964	28 Sqn	
BC825	MiG-21F-13	1964	28 Sqn	
BC826?	MiG-21PF	1964	28 Sqn	Destroyed 6-9-65
BC827	MiG-21PF	1964	28 Sqn	Destroyed 6-9-65

via Pushpindar Singh Chopra

▲
MiG-21F-13 BC821, one of the very first MiG-21s delivered to India.

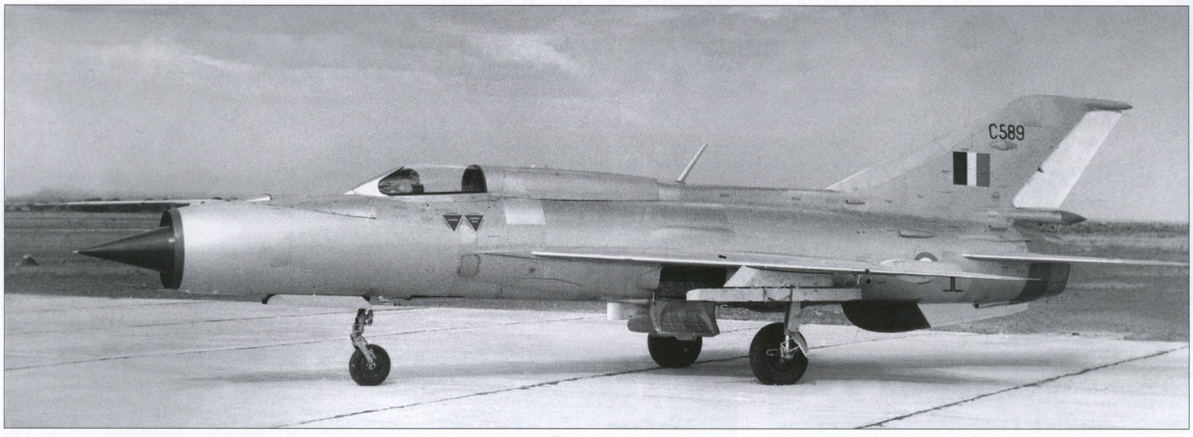
The specially selected team was led by Wg Cdr Dilbagh Singh (later CAS) and included Sqn Ldrs Surendra Kumar 'Polly' Mehra (also later CAS), Malcolm S. Dundas 'Mally' Wollen (later Air Marshal), Flt Lts Denzil Joseph Keelor (later Air Marshal) and Brijesh Jayal (later Air Marshal), Harcharan Singh 'High Speed' Gill, Arun Kanti Mukherjee and A. K. Sen. These were all highly qualified fighter pilots (also as pilot attack instructors and day fighter leaders), but the facilities for flying training at Loogovaya were appalling by IAF standards, while the quality of flying instructors was also 'below average'.

The October-November 1962 frontier war between India and China impacted on the attitudes and consequently training of IAF pilots in the Soviet Union. Keeping their frustration in check, the IAF pilots were given an abysmal four and a half hours of flying time over a five month period, although classroom instruction on aircraft engines, airframe and systems (via interpreters) was very good. Not surprisingly,

U455, a very weathered MiG-21U (*izdeliye* 66-400) belonging to the MiG Operational Flying Training Unit (OFTU), shows its three-tone camouflage.
▼

Simon Watson

HAL



▲ **Brand-new MiG-21FL C589 in its silver overall factory finish. This aircraft was delivered to 28 Sqn.**

every IAF pilot was assessed as 'exceptional' in flying.

The first six of an eventual 10 MiG-21F-13s (*izdeliye* 74) left the Ukrainian seaport of Odessa on 15th January 1963 and reached Bombay on 28th January. 28 Squadron at Chandigarh, Punjab, was the first unit to receive them and, to mark the occasion, adopted the sobriquet 'First Supersonics'. A second batch of four MiG-21F-13s reached India in mid-1964. The fighters received the serials BC816-BC825. They differed from other *izdeliye* 74s in having a vertical VHF blade aerial on the fuselage spine about halfway between the canopy and the vertical tail.

Two MiG-21PFs (*izdeliye* 76A) were delivered to India in late 1964 along with the second shipment of MiG-21F-13s; they, too, served with 28 Sqn. Subsequent events suggest that no more MiG-21PFs were ever ordered.

It had been planned to procure another 18 aircraft in 1965 but the Second Kashmir War with Pakistan erupted in September that year and the IAF went to war with its MiG-21 trials squadron boasting only eight serviceable aircraft. (Two had been lost in a mid-air collision during a training flight at Ambala AB, Haryana, on 21st December 1963; the pilots, Sqn Ldrs M. S. G. 'Mally' Wollen and A. K. Mukherjee, ejected.) The

Key Publishing

▲ **A MiG-21FL with a full complement of armament – two R-3S AAMs and a GP-9 cannon pod.**

▶ **Indian Air Force MiG-21FLs sported a variety of camouflage schemes. C746 operated by 28 Sqn wore a wraparound dark green/dark earth scheme.**

Key Publishing

'Indian Air Force MiG-21FL C993' preserved at Technik Museum Speyer, Germany, is an impostor; it is actually former Luftwaffe MiG-21PFM 22+25
C993
MiG-21FL C1003
MiG Operational Flying Training Unit (OFTU), Tezpur
C 1003
MiG-21FL C1124
30 Sqn 'Rhinos', Pune
C 1124
MiG-21FL C779
8 Sqn 'Eighth Pursoots', Bagdogra
C 779

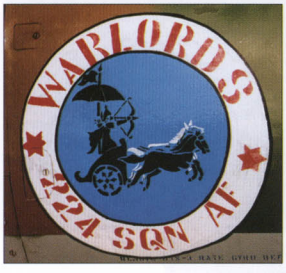
handful of MiG-21s played a limited role during the three weeks of warfare, being only utilised for combat air patrol duties over two forward airfields in the Punjab but had little occasion to fire their guns or missiles in anger. Moreover, both MiG-21PFs were reportedly destroyed on the ground when Pakistani F-86s raided Pathankot AB, Punjab, on 6th September 1965.

However, the Mikoyan OKB offered a developed version of the MiG-21PF with the R11F-300 engine, a fuel capacity increased to 2,900 litres (638 Imp gal), a parabrake repositioned below the rudder, an R-2L radar, underwing pylons capable of carrying fuel tanks and significantly, the capability of carrying a GP-9 gun pack under the fuselage. It was designated MiG-21FL (*izdeliye* 77), FL denoted *for**sazh**/lo**kat**or* (afterburner/radar). This was the version selected for licence production.

In late 1964 the original production plans had been revised as too ambitious. In mid-1966, the Department of Defence Production announced

Simon Watson

▲►
C1103 and other MiG-21FLs of MiG OFTU armed with rocket pods on the ramp at Tezpur.



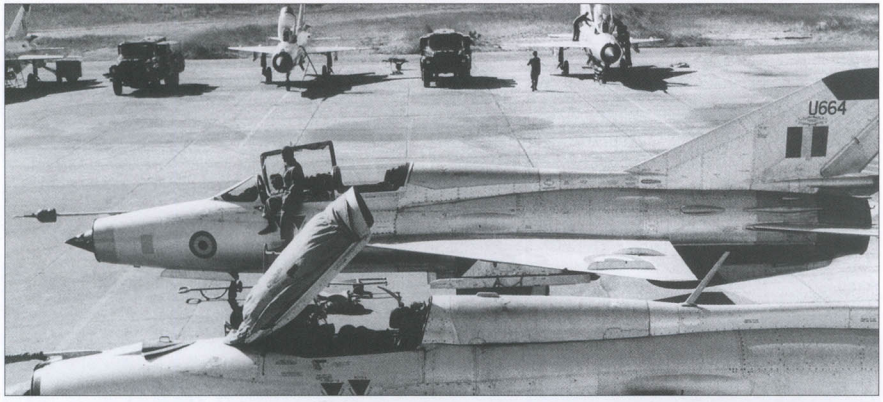
▲
The unit badge of 224 Sqn 'Warlords', another MiG-21 operator in the Indian Air Force.

Simon Watson

MiG-21FL C992 of 1 Sqn 'Tigers', Gwalior, in appropriate 'tiger' camouflage. This aircraft crashed at Ambala AB on 2nd September 1997

Key Publishing

◀ MiG-21U (*izdeliye* 66-600) U655 shows no unit insignia. Oddly, the IAF roundels are applied both ahead and aft of the wings.



Key Publishing

◀ Silver-painted MiG-21U (*izdeliye* 66-600) U664 shares the flight line with several MiG-21FLs interspersed with ground power units based on the Soviet ZiL-130 lorry.

Simon Watson

◀ Camouflaged MiG-21U (*izdeliye* 66-600) U661 operated by the MiG OFTU may be an ex-Romanian machine.

Known Indian Air Force MiG-21FLs

Serial	Version	Unit	Comments
C460	MiG-21FL	37 Sqn	
C499	MiG-21FL	3 Sqn	Silver overall. Preserved IAF Museum, Palam AB, Delhi
C504	MiG-21FL	30 Sqn	To MiG OFTU
C507	MiG-21FL	8 Sqn	
C508	MiG-21FL	30 Sqn	
C510	MiG-21FL	8 Sqn	Silver overall, rear fuselage and tail later painted green for war game
C518	MiG-21FL	37 Sqn	Silver overall
C520	MiG-21FL		Silver overall

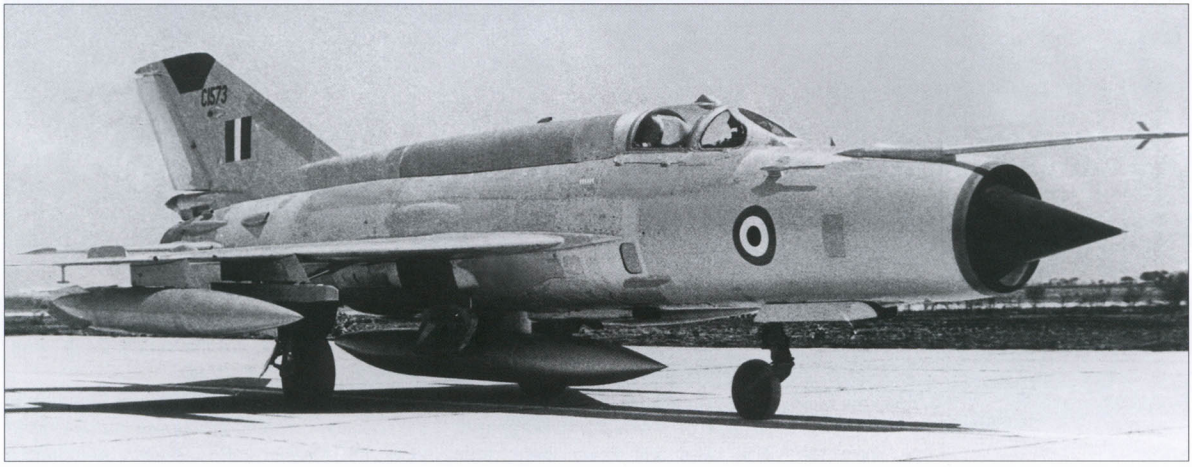
C524	MiG-21FL	MiG OFTU	Grey overall
C529	MiG-21FL	8 Sqn	Grey overall
C531	MiG-21FL	8 Sqn	
C560	MiG-21FL		Ground instructional airframe at Jallahali?
C582	MiG-21FL	52 Sqn	Grey overall
C585	MiG-21FL	37 Sqn	
C589	MiG-21FL	28 Sqn	Silver overall. To 8 Sqn, to MiG OFTU. Preserved at IAF Technical College, Jallahali
C590	MiG-21FL	28 Sqn	To MiG OFTU. Preserved at IAF Technical College, Jallahali
C593	MiG-21FL	MiG OFTU	
C595	MiG-21FL	MiG OFTU	Grey overall
C596	MiG-21FL	MiG OFTU	
C599	MiG-21FL	30 Sqn	Wings preserved at 30 Sqn Museum, Tezpur AB
C601	MiG-21FL	8 Sqn	Grey overall
C603	MiG-21FL	47 Sqn	Shot down by AAA at Agartala 12-12-1971 (also rep. crashed Palam AB this day)
C608	MiG-21FL	52 Sqn	
C619	MiG-21FL	MiG OFTU	
C699	MiG-21FL	28 Sqn	To 47 Sqn
C705	MiG-21FL	47 Sqn	Shot down by AAA in Southern Sind, Pakistan, 13-12-1971
C706	MiG-21FL	30 Sqn	Crashed 15-12-1999
C711	MiG-21FL	47 Sqn	
C716	MiG-21FL	29 Sqn	Shot down by Pakistani Air Force F-86F near Pasroor 17-12-1971
C717	MiG-21FL	MiG OFTU	Grey overall
C720	MiG-21FL	28 Sqn	To 47 Sqn
C724	MiG-21FL	30 Sqn	
C726	MiG-21FL	8 Sqn	Silver overall, black/yellow striped tail for war game; later green/tan/brown camouflage
C731	MiG-21FL	28 Sqn	Crude partial dark green/dark earth camouflage on silver background
C734	MiG-21FL	MiG OFTU	Grey overall
C736	MiG-21FL	52 Sqn	
C741	MiG-21FL	MiG OFTU	
C743	MiG-21FL	8 Sqn	Grey overall
C744	MiG-21FL	30 Sqn	
C746	MiG-21FL	28 Sqn	Dark green/dark earth wraparound camouflage
C747	MiG-21FL	52 Sqn	
C750	MiG-21FL	28 Sqn	To 47 Sqn. Scored a 'kill' against a Pakistani Air Force F-104A 17-12-1971
C751	MiG-21FL	30 Sqn	Grey overall. To MiG OFTU
C754	MiG-21FL	52 Sqn	Silver overall, black spots applied for war game
C755	MiG-21FL		
C757	MiG-21FL	MiG OFTU	
C761	MiG-21FL	MiG OFTU	To 30 Sqn. Crashed 26-3-1979 after engine fire, pilot ejected
C763	MiG-21FL	30 Sqn	
C764	MiG-21FL	29 Sqn	Shot down by AAA near Suleimanke 5-12-1971
C765	MiG-21FL	28 Sqn	To 47 Sqn
C766	MiG-21FL	8 Sqn	
C772	MiG-21FL		Silver overall
C773	MiG-21FL	8 Sqn	Silver overall, blue spots applied for war game
C776	MiG-21FL	8 Sqn	
C777	MiG-21FL	MiG OFTU	Grey overall
C778	MiG-21FL	MiG OFTU	Silver overall
C779	MiG-21FL	8 Sqn	Grey overall
C989	MiG-21FL	8 Sqn	Grey overall
C992	MiG-21FL	1 Sqn	Crashed at Ambala AB 2-9-1997
C996	MiG-21FL	8 Sqn	Green/tan/brown camouflage
C1002	MiG-21FL	52 Sqn	Grey overall
C1003	MiG-21FL	MiG OFTU	Grey overall
C1100	MiG-21FL	8 Sqn	
C1102	MiG-21FL	MiG OFTU	Wreck noted 2002 at Chabua base dump
C1105	MiG-21FL	52 Sqn	Silver overall
C1106	MiG-21FL		Preserved at Eastern Air Command HQ, Shillong

C1107	MiG-21FL	1 Sqn	Shot down accidentally by another MiG-21FL at Adampur 11-12-1971
C1108	MiG-21FL	8 Sqn	
C1111	MiG-21FL	28 Sqn	Silver overall, later grey overall
C1115	MiG-21FL	28 Sqn	To 47 Sqn
C1117	MiG-21FL	MiG OFTU	
C1124	MiG-21FL	30 Sqn	To MiG OFTU, green/tan/brown camouflage
C1126	MiG-21FL	MiG OFTU	
C1127	MiG-21FL	8 Sqn	Grey overall
C1128	MiG-21FL	1 Sqn	Silver overall, yellow/black chequered bars on either side of fuselage roundels
C1132	MiG-21FL	52 Sqn	
C1134	MiG-21FL	MiG OFTU	Grey overall
C1136	MiG-21FL		Noted 2002 as wreckage on the dump at Chabua
C1141	MiG-21FL	MiG OFTU	
C1147	MiG-21FL	MiG OFTU?	Green/tan/brown camouflage, former unit badge painted out
C1149	MiG-21FL	MiG OFTU	
C1152	MiG-21FL	52 Sqn	
C1163	MiG-21FL	MiG OFTU	
C1165	MiG-21FL	52 Sqn	
C1167	MiG-21FL		Preserved at Dundigal Air Force Academy, Hyderabad, near Air Cadets mess
C1168	MiG-21FL		Silver overall, black canopy frame. Preserved Pragathi Maidan Exhibition, Delhi
C1171	MiG-21FL	MiG OFTU	Green/tan/brown camouflage, former unit badge painted out
C1174	MiG-21FL	MiG OFTU	Grey overall, former unit badge painted out
C1175	MiG-21FL		Preserved at Hindustan Aerospace Museum, Nasik

HAL

◄
C1532, the first HAL-built MiG-21M, with appropriate titles.

MiG-21M C1573 in ferry configuration with three drop tanks.
▼



HAL

▲ **The badge of 28 Sqn, the Indian Air Force's first MiG-21 unit.**

Known Indian Air Force MiG-21Ms (Soviet-built)

Serial	OKB designation	IAF designation	Delivery	Unit	Comments
C1474	MiG-21M (*izd.* 96)	MiG-21MF	1971	101 Sqn	
C1478	MiG-21M (*izd.* 96)	MiG-21MF	1971	101 Sqn	Silver overall, black spots applied for war game
C1482	MiG-21M (*izd.* 96)	MiG-21MF	1971	108 Sqn	Silver overall
C1485	MiG-21M (*izd.* 96)	MiG-21MF	1971	108 Sqn	
C1487	MiG-21M (*izd.* 96)	MiG-21MF	1971	7 Sqn	
C1494	MiG-21M (*izd.* 96)	MiG-21MF	1971	101 Sqn	
C1495	MiG-21M (*izd.* 96)	MiG-21MF	1971	101 Sqn	Silver overall, green spots applied on tail for war game
C1497	MiG-21M (*izd.* 96)	MiG-21MF	1971	7 Sqn	
C1500	MiG-21M (*izd.* 96)	MiG-21MF	1971	101 Sqn	Silver overall, red/white striped tail for war game
C1501	MiG-21M (*izd.* 96)	MiG-21MF	1971	7 Sqn	
C1521	MiG-21M (*izd.* 96)	MiG-21MF	1971	7 Sqn	

Known Indian Air Force MiG-21Ms (HAL-built)

Serial	Version	IAF designation	Delivery	Unit	Comments
C1531	MiG-21M (type 88)	MiG-21M	1971	108 Sqn	Soviet-built pattern aircraft. Silver overall, black and yellow spots applied on tail for war game
C1532	MiG-21M (type 88)	MiG-21M	1973		First HAL-built Type 88. Silver overall, '1st MiG-21M' nose titles
C1535	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1539	MiG-21M (type 88)	MiG-21M		17 Sqn	Shot down by Pakistani SAM near Kargil, Jammu & Kashmir, 27-5-1999 during an air strike on Islamic forces
C1540	MiG-21M (type 88)	MiG-21M		37 Sqn	Silver overall
C1548	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1556	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1573	MiG-21M (type 88)	MiG-21M			Silver overall
C1576	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1586	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1592	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1594	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1598	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1599	MiG-21M (type 88)	MiG-21M			Preserved at Central Air Command HQ, Allahabad
C1603	MiG-21M (type 88)	MiG-21M		7 Sqn	
C1608	MiG-21M (type 88)	MiG-21M		108 Sqn	Grey overall
C1611	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1612	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1616	MiG-21M (type 88)	MiG-21M			Crashed 9-6-1995
C1625	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1631	MiG-21M (type 88)	MiG-21M			Crashed 21-2-2004
C1632	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1633	MiG-21M (type 88)	MiG-21M		108 Sqn	
C1635	MiG-21M (type 88)	MiG-21M			Grey overall. Crashed at Jamnagar 20-2-2004
C1666	MiG-21M (type 88)	MiG-21M			Crashed 9-6-1995
C1679	MiG-21M (type 88)	MiG-21M		108 Sqn	Grey overall
C1690	MiG-21M (type 88)	MiG-21M			Noted 2006

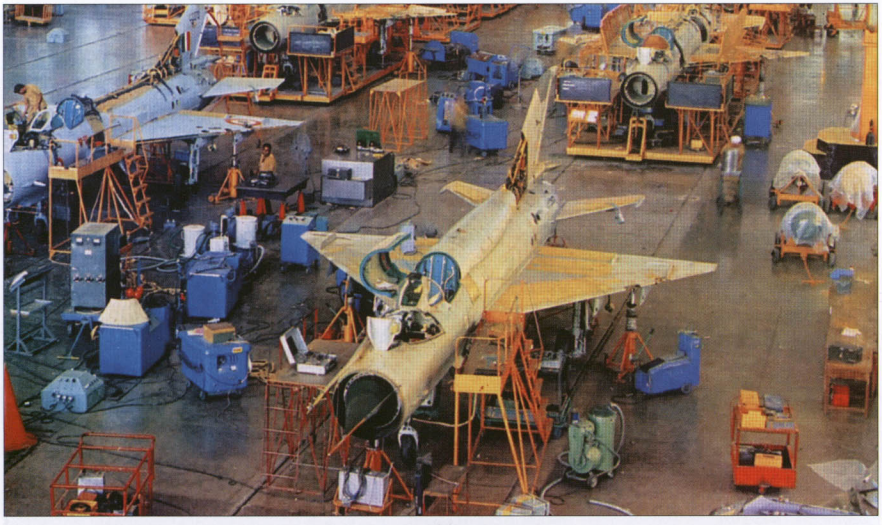
that the MiG-21 manufacture programme in India was to proceed in four stages, starting with assembly from completely knocked-down (CKD) kits, advancing to sub-assemblies, parts and, finally, raw materials. In order to assist the programme, a batch of 54 MiG-21FLs purchased from the USSR was test flown there, then dismantled, shipped to India and reassembled at Nasik, Maharashtra, under Russian supervision. These aircraft received the serials C450-C458, C498-C535 and C582-C588.

The manufacturing project was handled by the specially created Aeronautics (India) Limited (later MiG-Division of Hindustan Aeronautics

Limited). Licence production took place at a new purpose-built Hindustan Aeronautics Ltd (HAL) airframe plant at Ozar near Nasik between 1966 and 1973. Another new factory was erected near Koraput, Orissa, to build the engines and yet another at Balanagar near Hyderabad, Andhra Pradesh, to make the avionics and missiles. 205 MiG-21FLs were built, the process progressing from the basic assembly of Soviet CKD kits, on to production of most of the airframe and the fitting of imported engines and finally, the manufacture of almost the complete aircraft. The first Indian-assembled MiG-21FL was handed over to the IAF in early 1967 and the first example entirely built from local components on 19th October 1970. The first HAL-built R11F2S-300 turbojet was delivered on 2nd January 1969. Indian production of the MiG-21FLs totalled 196.

via Internet

▲
IAF MiG-21s often had colourful identification markings applied for war games, as illustrated by these three 101 Sqn MiG-21Ms.



HAL

◄
The MiG-21*bis* assembly line at HAL Nasik. The aircraft on the left, C2370, appears to be undergoing refurbishment.

MiG-21*bis* fighters operated by the Tactics & Air Combat Development Establishment (TACDE) on the ramp at Gwalior. The fighters wear the IAF's current overall grey colours. Note the IFF blade aerial ahead of the canopy characteristic of HAL-built examples.
▼

www.bharat-rakshak.com

Simon Watson

▲ **21 Sqn MiG-21*bis* fighters (including C2123 and C2263) all adorned for a war game at Chandigarh.**

Simon Watson

▶ **Well-weathered MiG-21*bis* C2196 in 'war paint'.**

The IAF has a habit of giving popular names to the aircraft it operates, even to those that have one already; the MiG-21FL was dubbed *Trishul* (Trident). MiG-21FLs assembled from CKD kits were given the serials within the ranges C589-C611, C698-C779 and C979-C1004, while those built entirely by HAL were serialled within the range C1100-C1174. However, not all of these serials were actually used; the purpose was to fool outsiders (read: spies) into thinking the IAF had more aircraft than it actually had.

The MiG-21 represented an entirely new generation of combat aircraft of the Mach 2, missile age and the IAF adapted new techniques

Known Indian Air Force MiG-21*bis* fighters

Serial	Version	Unit	Comments
C2071	MiG-21*bis*	23 Sqn	Crashed 17-9-2001
C2075	MiG-21*bis*	TACDE	Grey overall
C2077	MiG-21*bis*	TACDE	
C2079	MiG-21*bis*		Rebuilt as Bison CU2079
C2084	MiG-21*bis*		Crashed 1-11-2004
C2088	MiG-21*bis*		Crashed 5-8-2000
C2090	MiG-21*bis*		Instructional airframe, National Aerospace Laboratories, Bangalore
C2096	MiG-21*bis*	3 Sqn	Grey overall
C2098	MiG-21*bis*		Preserved as gate guard, Poona AB
C2100	MiG-21*bis*	51 Sqn	
C2105	MiG-21*bis*		Rebuilt as Bison CU2105
C2106	MiG-21*bis*		Rebuilt as Bison CU2106
C2112	MiG-21*bis*	23 Sqn	
C2113	MiG-21*bis*	15 Sqn	Grey overall, centre/rear fuselage and tail painted yellow with black spots for war game
C2115	MiG-21*bis*	15 Sqn	
C2117	MiG-21*bis*		Grey overall. Reported upgraded 1999
C2119	MiG-21*bis*	3 Sqn	Rebuilt as Bison CU2119
C2122	MiG-21*bis*		Grey overall
C2123	MiG-21*bis*	21 Sqn	Grey overall
C2126	MiG-21*bis*	3 Sqn	Rebuilt as Bison CU2126
C2189	MiG-21*bis*		Rebuilt as Bison CU2189
C2196	MiG-21*bis*	15 Sqn	Grey overall, yellow/black striped tail for war game. Rebuilt as Bison CU2196

C2199	MiG-21*bis*	32 Sqn	Rebuilt as Bison CU2199
C2204	MiG-21*bis*		Grey overall
C2205	MiG-21*bis*	4 Sqn	
C2210	MiG-21*bis*	45 Sqn	Grey overall, rear fuselage and tail painted black for war game
C2217	MiG-21*bis*		Crashed 11-8-1994 after systems failure
C2233	MiG-21*bis*	TACDE	
C2236	MiG-21*bis*	37 Sqn	Grey overall
C2250	MiG-21*bis*	3 Sqn	Rebuilt as Bison CU2250
C2251	MiG-21*bis*		Crashed 6-1-1995 after birdstrike
C2252	MiG-21*bis*		Rebuilt as Bison CU2252, grey overall
C2262	MiG-21*bis*	21 Sqn	Rebuilt as Bison CU2262
C2263	MiG-21*bis*	21 Sqn	Grey overall, 'Ankush' titles on tail, yellow spots all over for war game
C2264	MiG-21*bis*		Grey overall, large lightning bolt on fuselage for war game
C2266	MiG-21*bis*	37 Sqn	
C2268	MiG-21*bis*	23 Sqn	
C2272	MiG-21*bis*		Rebuilt as Bison CU2272
C2275	MiG-21*bis*		Rebuilt as Bison CU2275
C2276	MiG-21*bis*		Rebuilt as Bison CU2276, crashed 9-9-2002
C2277	MiG-21*bis*		Damaged beyond repair on landing 12-12-1994 and scrapped
C2281	MiG-21*bis*	26 Sqn	Grey overall, named 'Sanu'. To 45 Sqn
C2283	MiG-21*bis*	3 Sqn	
C2284	MiG-21*bis*		Grey overall. Preserved IAF Museum, Palam AB, Delhi
C2305	MiG-21*bis*	4 Sqn	Grey overall, fuselage spine and tail painted in black and red stripes for war game
C2312	MiG-21*bis*	3 Sqn	Green/black camouflage, cobra nose art
C2316	MiG-21*bis*	24 Sqn	Green/tan/brown camouflage
C2323	MiG-21*bis*	4 Sqn	Three-tone grey camouflage
C2324	MiG-21*bis*	37 Sqn	Grey overall, yellow band near cockpit and yellow tail for war game
C2325	MiG-21*bis*		Rebuilt as Bison CU2325
C2327	MiG-21*bis*		Rebuilt as Bison CU2327, grey overall
C2769	MiG-21*bis*		Grey overall. Rebuilt as second prototype Bison (C2769/002) in orange/green/white special colours, later changed to CU2769, grey overall
C2770	MiG-21*bis*	TACDE	Grey overall
C2771	MiG-21*bis*		Rebuilt as Bison CU2771, grey overall
C2776	MiG-21*bis*	26 Sqn	Dark brown/tan mottled camouflage
C2777	MiG-21*bis*		Grey overall. Rebuilt as first prototype Bison (C2777/001) in orange/green/white special colours, later changed to CU2777, grey overall
C2780	MiG-21*bis*		Rebuilt as Bison CU2780, grey overall
C2781	MiG-21*bis*	26 Sqn	Green/tan/brown camouflage. To ASTE
C2782	MiG-21*bis*		Rebuilt as Bison CU2782
C2785	MiG-21*bis*		Rebuilt as Bison CU2785
C2787	MiG-21*bis*	24 Sqn	Grey overall
C2788	MiG-21*bis*	24 Sqn	Grey overall, yellow stripes applied for war game
C2793	MiG-21*bis*	24 Sqn	
C2794	MiG-21*bis*	3 Sqn	Rebuilt as Bison CU2794, grey overall
C2796	MiG-21*bis*		Rebuilt as Bison CU2796
C2797	MiG-21*bis*	23 Sqn	Crashed in Jallandar city 3-5-2002
C2798	MiG-21*bis*	17 Sqn	Crashed Delhi-Nazafgarh 8-11-1988 during flypast
C2800	MiG-21*bis*		Crashed on night approach to Uttarlai 21-10-2002
C2801	MiG-21*bis*		Rebuilt as Bison CU2801
C2809	MiG-21*bis*	TACDE	
C2819	MiG-21*bis*	4 Sqn	Grey overall, rear fuselage and tail painted in black and yellow stripes for war game. To 32 Sqn; rebuilt as Bison CU2819, grey overall
C2821	MiG-21*bis*	15 Sqn	To TACDE. Grey overall
C2824	MiG-21*bis*	24 Sqn	Grey overall
C2826	MiG-21*bis*	24 Sqn	Rebuilt as Bison CU2826
C2829	MiG-21*bis*	4 Sqn	Crashed
C2833	MiG-21*bis*	4 Sqn	
C2836	MiG-21bis		Preserved at the Hindustan Aerospace Museum

Known Indian Air Force MiG-21U trainers

Serial	Version	C/n	In-service date	Unit	Comments
U360	MiG-21U	?		8 Sqn	
U455	MiG-21U (*izd.* 66-400)	?		MiG OFTU	Ex-Romanian AF? Green/tan/brown camouflage
U460	MiG-21U (*izd.* 66-600)	?		8 Sqn	Silver overall
U553	MiG-21U	?		7 Sqn	Crashed Kanpur 29-10-1982
U655	MiG-21U (*izd.* 66-600)	?			Silver overall
U656	MiG-21U	?			
U657	MiG-21U	?			
U658	MiG-21U	?			
U659	MiG-21U	?			
U660	MiG-21U (*izd.* 66-600)	?		8 Sqn	Green/tan/brown camouflage. Withdrawn 1993 preserved at College of Defence Management, Alwal
U661	MiG-21U (*izd.* 66-600)	?		MiG OFTU	Ex-Romanian AF? Green/tan/brown camouflage, silver nose
U662	MiG-21U	?			
U663	MiG-21U	?			
U664	MiG-21U (*izd.* 66-600)	?			Silver overall
U670	MiG-21U (*izd.* 66-400)	660820	1986-7		Ex-Hungarian AF 0820
U671	MiG-21U (*izd.* 66-400)	661420	1986-7		Ex-Hungarian AF 1420, crashed 2-1988
U672	MiG-21U (*izd.* 66-400)	661720	1986-7		Ex-Hungarian AF 1720
U673	MiG-21U (*izd.* 66-400)	661816	1986-7		Ex-Hungarian AF 1816
U674	MiG-21U (*izd.* 66-400)	661817	1986-7		Ex-Hungarian AF 1817
U1719	MiG-21U	?		30 Sqn	To MiG OFTU
U1724	MiG-21U	?		MiG OFTU	
U1726	MiG-21U	?			
U1727	MiG-21U	?		8 Sqn	
U1729	MiG-21U	?		8 Sqn	Silver overall. Crashed 15-7-2002
U1737	MiG-21U	?		52 Sqn	
U2972	MiG-21U	?		MiG OFTU	
U2974	MiG-21U (*izd.* 66-400)	?			Grey overall. Noted 2004 at the HAL Heritage Centre
U3001	MiG-21U (*izd.* 66-400)	660919			Ex-Hungarian AF 919
U3002	MiG-21U (*izd.* 66-400)	661419			Ex-Hungarian AF 1419
U3003	MiG-21U (*izd.* 66-600)	664117			Ex-Hungarian AF 4117
U3004	MiG-21U (*izd.* 66-600)	664420		30 Sqn	Ex-Hungarian AF 4420. To MiG OFTU, now preserved as gate guard there

in operations, maintenance and employment of supporting ground systems. The MiG-21FL was a superb aircraft for close combat and had excellent handling characteristics and high performance, the technical staff being as enthusiastic about its servicing and maintenance simplicity, but the IAF demanded that the fighter be urgently modified to address its limited armament and range. Consultations with the Russians led to some major improvements, the main heads of modification concerning an increase in internal fuel capacity, more effective brake pressure and the eventual incorporation of larger capacity drop tanks, a cannon pod and a

MiG-21UM U4003 operated by the TACDE in the current low-visibility grey colours. The silver-painted canopy of the rear cockpit appears to be a replacement item.

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Known Indian Air Force MiG-21UMs

Serial	Version	Delivery date	Unit	Comments
U665	MiG-21UM			
U666	MiG-21UM			
U667	MiG-21UM			
U668	MiG-21UM			
U669	MiG-21UM			
U1725	MiG-21UM		52 Sqn	Grey overall
U1737	MiG-21UM		MiG OFTU	
U1739	MiG-21UM		8 Sqn	Grey overall
U1740	MiG-21UM		MiG OFTU	Grey overall
U2142	MiG-21UM		21 Sqn	Grey overall
U2151	MiG-21UM		52 Sqn	
U2156	MiG-21UM			
U2157	MiG-21UM		TACDE	
U2159	MiG-21UM			
U2163	MiG-21UM		101 Sqn	Green/tan/brown camouflage
U3282	MiG-21UM			Noted in 2000
U3296	MiG-21UM	1990	ASTE	Grey overall
U4003	MiG-21UM		TACDE	Grey overall
U4004	MiG-21UM			Grey overall with green/tan camouflaged spine (replacement parts?). Noted in 1999
U4005	MiG-21UM		108 Sqn	
U4006	MiG-21UM		108 Sqn	

Wearing a special colour scheme in Indian national colours, the first prototype MiG-21*bis* UPG makes a rather strange sight as it sits on the Sokol factory apron at Nizhniy Novgorod-Sormovo, with very Russian birch trees as a backdrop. Note the one-piece windshield, the chaff/flare dispensers above the wing roots, the RHAWS aerials on the fin and the photo calibration markings. ▼

Sokol factory, IAF and HAL representatives pose for a photo with the two MiG-21*bis* UPG (Bison) prototypes, C2777/001 and C2769/002. ▼▼

gun sight. The GP-9 pod housing the 23-mm GSh-23 twin-barrel cannon, and the computing gun sight with an electrical ranging system, were imported as kits from the Soviet Union and the fighters were modified by Base Repair Depots of the IAF. The cannon pod became an additional notch in the confidence factor, pilots no longer have to face the uncomfortable prospect of being left unarmed after the two missiles were fired in the first few seconds of combat. In place of the 490-litre central auxiliary fuel tank, the IAF modified is MiG-21s to carry similar capacity drop tanks under each wing, thus greatly increasing endurance, range and firepower.

Nine squadrons were equipped with the MiG-21FL by 1971: 1 Sqn 'Tigers' at Gwalior, Madhya Pradesh; 3 Sqn 'Cobras' at Pathankot; 4 Sqn 'Oorials' at Jaisalmer, Rajasthan; 8 Sqn 'Pursoots' (*sic*) at Baghdogra, Bengal; 28 Sqn 'First Supersonics'; 29 Sqn 'Black Scorpions' at Jodhpur, Rajasthan; 30 Sqn 'Charging Rhinos' at Tezpur, Assam; 45 Sqn 'Flying Daggers' at Naliya, Gujarat; and 47 Sqn 'Black Archers' at Adampur, Punjab.

As these units were *la créme de la créme* of the IAF, when more advanced aircraft arrived their MiG-21FLs were replaced and transferred to other units, such as 37 Sqn 'Black Panthers' at Jodhpur; 52 Sqn 'Sharks' (an Operational Conversion Unit) at Chabua, Assam; MiG OFTU (MiG

Sokol

Sokol

Sokol

Sokol

▲ **Two more views of the first prototype MiG-21*bis* UPG (Bison) at Nizhniy Novgorod in December 2000, looking even more out of place in a Russian winter setting. Note the bulged canopy. Upon delivery the aircraft was reserialled CU2777 and received an overall grey camouflage scheme.**

Operational, Flying Training Unit) at Tezpur (later at Jamnagar, Gujarat) and the Tactics & Air Combat Development Establishment (TACDE) at Jamnagar.

MiG-21FL survivors were withdrawn from active service in 2005 (see pages 583-585).

In 1971, MMZ No. 30 'Znamya Truda' delivered 65 MiG-21Ms (*izdeliye* 96) to the IAF, they were part of deal whereby an improved version, the MiG-21M (type 88), was to be built under licence at HAL. (Note: Since the sub-type of the MiG-21M manufactured by HAL under licence was built solely in India, the usual *izdeliye* designator is not applicable.) To distinguish between the two similar variants the *izdeliye* 96 was given the local designation MiG-21MF and it is unfortunate that MiG OKB used the MiG-21MF designation for a different export design (*izdeliye* 96F) very similar, but not identical, to the Indian-built MiG-21M (type 88). The newly arrived fighters featured a built-in GSh-23L cannon, an RP-21MA radar and an ASP-PFD computing gunsight and were powered by an R11F2S-300 engine with air bleed for the blown flaps.

The aircraft were given the serials C1466-C1530 (see table on page 586 for details).

The Soviet-built pattern aircraft for the MiG-21M (type 88), C1531, arrived in India in 1971 and preparations for the production at HAL of 158 new aircraft began; the first was handed over to the IAF on 14th February 1973 and the last on 12th November 1981. With the more powerful R13-300 engine, better RP-22 radar, periscope on the canopy and baffle plates below

Simon Watson

▶ **3 Sqn airmen pose with MiG-21*bis* UPG CU2794 at Ambala, with weapons arrayed in front.**

the auxiliary inlet doors it was virtually identical to the MiG-21MF (*izdeliye* 96F) and was of a superior specification to the MiG-21M (*izdeliye* 96). There is no absolute certainty of the serials for these fighters but C1531-C1690 is a reasonable estimate (see page 588).

The following units are known to have received the MiG-21M (type 88 and *izdeliye* 96): 7 Sqn 'Battle Axes' at Gwalior; 9 Sqn 'Wolfpack' at Hindon, Haryana; 17 Sqn 'Golden Arrows' at Bhatinda, Punjab; 35 Sqn 'Rapiers' at Bakshi Ka Talab, Uttar Pradesh (12 aircraft with ECM capability); 37 Sqn 'Black Panthers'; 51 Sqn 'Sword Arms' at Jamnagar; 52 Sqn 'Sharks'; 72 Sqn, 101 Sqn 'Falcons' at Sirsa, Haryana; 108 Sqn 'Hawkeyes' at Bakshi Ka Talab; and the TACDE.

The last and most advanced variant was the MiG-21*bis* (*izdeliye* 75A), which was designed as an all-round fighter and had a new R25-300 engine to improve low-altitude performance. It was known in the IAF as *Vikram* (Hero).

The Indian government received a licence to manufacture the variant in 1974 and 75 kits were delivered in 1977 for assembly at HAL where a further 220 were built from scratch by 1984. Serials used were: C2067-C2141 for the kits, and C2185-C2334, C2761-C2830 for HAL products. The existence of MiG-21*bis* C2836 in the Hindustan Aerospace Museum suggests that either one of the previous serials had not been

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▲ **MiG-21*bis* UPG CU2780 taxies out for take-off with two drop tanks. Note the second AoA sensor on the starboard side of the nose.**

used or that up to 226 had been built at HAL, contrary to previous reports.

The MiG-21*bis* is known to have served with 3 Sqn 'Cobras'; 4 Sqn 'Oorials'; 15 Sqn 'Flying Lances' at Bhuj, Gujarat; 21 Sqn 'Ankush' at Chandigarh; 23 Sqn 'Cheetahs' at Ambala; 24 Sqn 'Hunting Hawks' at Bareilly, Uttar Pradesh; 26 Sqn 'Warriors' at Pathankot; 32 Sqn 'Thunderbirds' at Jamnagar; 35 Sqn 'Rapiers', 36 Sqn 'Killers' (?), 37 Sqn 'Black Panthers'; 45 Sqn 'Flying Daggers', 51 Sqn 'Sword Arms'; 52 Sqn 'Sharks'; the Aircraft & Systems Testing Establishment (ASTE) at Bangalore, Karnataka; and the TACDE. See table on pages 588-589.

Occasioned by the delay in the delivery of the indigenous HAL Tejas multi-role fighter (originally known as the LCA), the Indian government decided to upgrade 125 MiG-21*bis* (plus an option for 50 more) to extend their useful life to 2017. Approval was given in principle in January 1996 and a joint study was undertaken with RSK MiG and the Sokol factory plus some Western companies for a Total Technical Life Extension programme. Six contracts were signed in March 1996: three with Russian companies for aircraft, armament and Phazotron Kopyo radar and three with Western companies for some avionics and instrumentation. Later, more contracts were sealed with Indian companies for a new avionics system. Sokol undertook to modify two Indian MiG-21bis as prototypes for the upgrade and the first flight was on 6th October 1998 and after extensive trials both aircraft were delivered in July 2001. HAL then proceeded to work on upgrading the other 123 aircraft. The first flight of a HAL upgrade on C2794 was on 31st August 2001. By 16th January 2006 HAL had upgraded 94 aircraft but three had been lost in accidents. At first, the designation MiG-21UPG (or MiG-21*bis* UPG) was used but this was soon changed to MiG-21 Bison. The original serials were modified by adding a 'U' to the 'C' prefix after being upgraded.

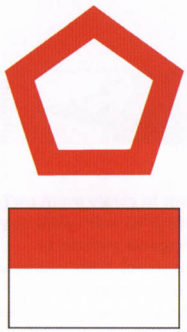
Known squadrons equipped with Bisons are 3 Sqn 'Cobras', 4 Sqn 'Oorials', 15 Sqn 'Flying Lances', 21 Sqn 'Ankush', 23 Sqn 'Cheetahs', 24 Sqn 'Hunting Hawks', 26 Sqn 'Warriors', 32 Sqn 'Thunderbirds', 35 Sqn 'Rapiers', 37 Sqn 'Black Panthers', 45 Sqn 'Flying Daggers' and 51 Sqn 'Sword Arms'.

The first two-seat trainer variant of the MiG-21 was delivered to India in late 1965, two years after the arrival of the first single-seat fighter. The subtype of all the trainers received is not known and so the aircraft are listed below in numerical order with subtypes added where known. Not all were new when delivered, some having been purchased from East European countries and former Soviet republics in the 1990s and 2000s.

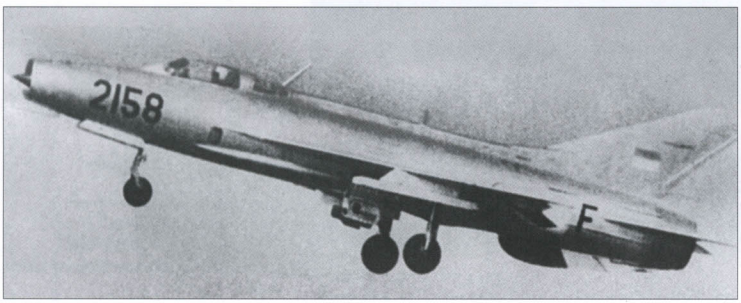
Some 40 MiG-21Us of both varieties were obtained and fighter squadrons normally had two of these MiG-21 trainers on strength. The incomplete MiG-21U list on page 590 includes the MiG-21U (*izdeliye* 66-400) with the narrow-chord tail and the MiG-21U (*izdeliye* 66-600) with the broader-chord tail (later production also had the canopy periscope), but neither of these variants had blown flaps. By mid-1971 it has been reported that 40 *izdeliye* 66 trainers were in service with the IAF. Five were sold by the Ukraine to India in 1997. If the sub-variant cannot be confirmed, 'MiG-21U' is shown in the 'Version' column.

No record has been found of any MiG-21USs (*izdeliye* 68A) in IAF service. This variant was externally similar to the late-production MiG-21U (*izdeliye* 66-600) with the canopy periscope, but had blown flaps, for which the flap hinges and its underwing fairing was moved to a position between the undercarriage and the fuselage.

The most advanced trainer variant was the MiG-21UM (*izdeliye* 69A), which, externally, looked the same as the MiG-21US except for a sweptback dorsal radio aerial and the angle of attack sensor on the port side of the nose. Reports state that about 70 of this variant were purchased, including some received in the 1990s from Eastern European countries and, in 2000-2003, 19 from Kyrghyzstan, three from the Ukraine and one from Russia.



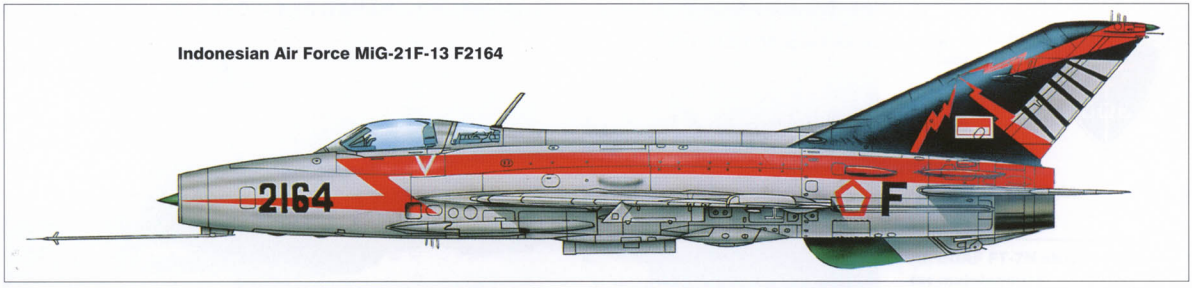
Indonesian Air Force MiG-21F-13 F2158 takes off. The F in the serial stands for 'fighter'. ▼



via RART

Indonesia

The **Indonesian Air Force** (*Angkatan Udara Republik Indonesia*, AURI; now called *Tentara Nasional Indonesia* – Angkatan Udara, TNI-AU) was formed on 17th August 1945 after the Dutch East Indies had been liberated from the Japanese and while the new Republic was still fighting the Dutch. The struggle for complete independence lasted until 27th December 1949, during which time most the aircraft of the AURI had been destroyed. President Dr. Sukarno

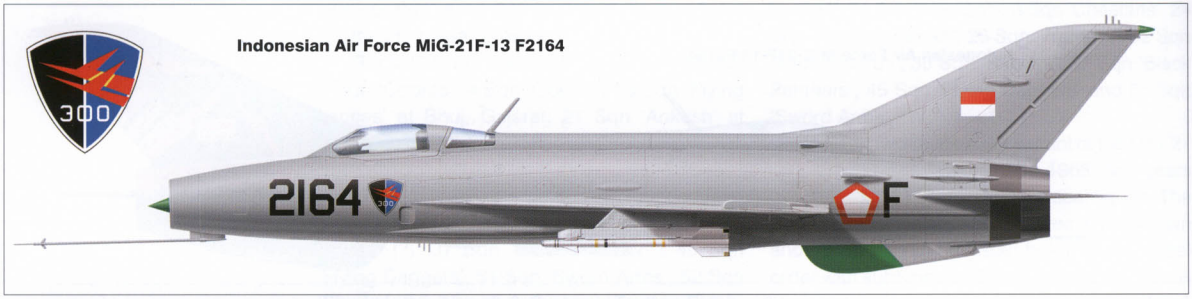


Peter Davison

◄ **MiG-21F-13 F2160 on display at the Indonesian Air Force Museum in Yogyakarta.**

Indonesian Air Force MiG-21F-13s

Serial	Version	C/n	Delivery date	Comments
F2151	MiG-21F-13		1962	To USA
F2152	MiG-21F-13		1962	To USA
F2153	MiG-21F-13		1962	To USA, now preseved at Nellis AFB, NV, as '84'
F2154	MiG-21F-13		1962	Written off c.1968
F2155	MiG-21F-13		1962	To USA
F2156	MiG-21F-13		1962	To USA
F2157	MiG-21F-13	N74212107	1962	To USA, now preserved at Bruxelles Army Museum, Belgium
F2158	MiG-21F-13	N74212101	1962	Ground instructional airframe at Bandung Technical College in fake three-tone grey/blue camouflage with 'Iron-Bird MiG-21' titles
F2159	MiG-21F-13		1962	To USA
F2160	MiG-21F-13		1962	Preserved TNI-AU Museum, Yogyakarta, special colours with red lightning bolt
F2161	MiG-21F-13		1962	To USA
F2162	MiG-21F-13		1962	To USA
F2163	MiG-21F-13	N74212106	1962	To USA, preserved at National Air and Space Museum Steven F. Udvar-Hazy Center, VA
F2164	MiG-21F-13		1962	Preserved Jakarta Museum, special colours with red lightning bolt and black tail
F2165	MiG-21F-13		1962	
F2166	MiG-21F-13		1962	To USA
F2167	MiG-21F-13		1962	Preserved Jakarta-Halim, special colours with red lightning bolt
F2168	MiG-21F-13		1962	
F2169	MiG-21F-13		1962	
F2170	MiG-21F-13	N74212116	1962	To USA



Indonesian Air Force MiG-21F-13 F2164

Known Indonesian Air Force MiG-21U trainers				
Serial	Version	C/n	Delivery date	Comments
T2171	MiG-21U (*izd.* 66-400)	51660703	1962	Written off
T2172	MiG-21U (*izd.* 66-400)	51660704	1962	To USA

proceeded to build up the Air Force, using mostly Western equipment, but in 1958 aircraft were procured from Eastern European states and China. A large order for Soviet arms placed in 1961 included 20 MiG-21F-13 (*izdeliye* 74) interceptors, which arrived in 1962. After an unsuccessful communist coup started on 30th September 1965, and a bloody purge that followed, President Sukarno slowly lost power and Major General Suharto became President in March 1963. Suharto favoured the USA as an arms supplier and most of the ex-Warsaw Pact aircraft were withdrawn in 1970. Furthermore, at least 13 MiG-21F-13 fighters and a MiG-21U trainer were transferred to the USA for test purposes.

At least two MiG-21U (*izdeliye* 66-400) trainers arrived in Indonesia around 1962, one ultimately finding its way to the USA.

Iran

The **Islamic Republic of Iran Air Force** (IRIAF) was formed from the Imperial Iranian Air Force

▶ **Bearing no national insignia or serial, an F-7N awaits delivery to the IRIAF.**

▶▶ **These ex-East German aircraft (a MiG-21PF and a MiG-21UM) were earmarked for delivery to Iran but impounded at Dresden.**

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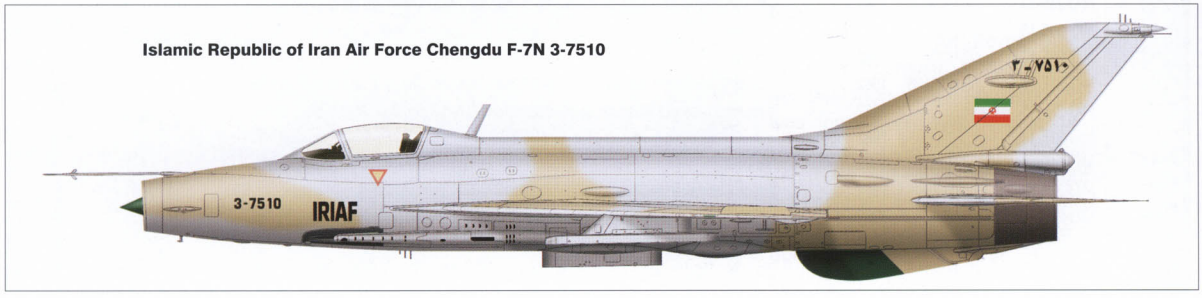

Islamic Republic of Iran Air Force Chengdu F-7N 3-7510

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◄
Soon-to-be-Iranian F-7Ns on the factory apron at Chengdu.

F-7N 3-7510 at an airshow in Tehran.
▼

F-7N 3-7514 in flight.
▼▼

An IRIAF FT-7N stripped down for maintenance.
▼◄

FT-7N 3-7703 in a red/white demonstrator scheme.
▼▼◄

via Internet

via Internet

www.MiG-21.de

via Internet

via Internet

via Internet

Known examples :

Serial	Type	Comments
3-7510	F-7M	Arabic serial
3-7512	F-7M	
3-7514	F-7M	Arabic serial
3-7515	F-7M	
3-7521	F-7M	
3-7524	F-7M	
3-7527	F-7M	
3-7603	F-7N	
3-7607	F-7N	
3-7702	F-7N	
3-7703	FT-7	Exact designation not known. Red/white special colour scheme, Arabic serial
3-7709	FT-7	'European' serial
3-7714	FT-7	Exact designation not known
3-771...	FT-7	'European' serial, last digit not readable

(IIAF) after the Islamic Revolution of 1979 that ousted Shah Mohammed Reza Pahlevi. During and after the war with Iraq, which raged from September 1980 to August 1988, Iran tried to rebuild its stock of aircraft and in 1989 purchased 12 MiG-21PFs and a number of MiG-21UMs from East Germany but the aircraft were impounded at the repair plant in Dresden and none were delivered. (Some sources suggest 2 arrived in Iran but this is doubtful.) Photos exist of a MiG-21PF and a MiG-21UM wearing green/tan desert camouflage but no insignia whatsoever.

18 Chengdu F-7Ms were ordered in 1985 and delivered in 1987; some sources suggest the number was 21. Additionally, four Guizhou FT-7 trainers were procured at the same time. Understandably there was great secrecy about this order as China was already supplying large numbers of F-7s to Iraq.

Based at TAB 5, Umidiyeh, they serve with 51, 52 and 53 Tactical Fighter Squadrons and wear tan/bluish grey camouflage. No confirmation has been found for a story in circulation suggesting that 12 were successfully used in the Iraqi war thanks to their similarity to the enemy's MiG-21s, nor that a further 100 were subsequently ordered.

However, the delivery in 1993 of 18 F-7Ns and seven FT-7 trainers, and five more in 1996 have been recorded.

It has also been suggested that the Air Force wing of the Islamic Revolutionary Guard Corps (IRGC) also use this fighter.

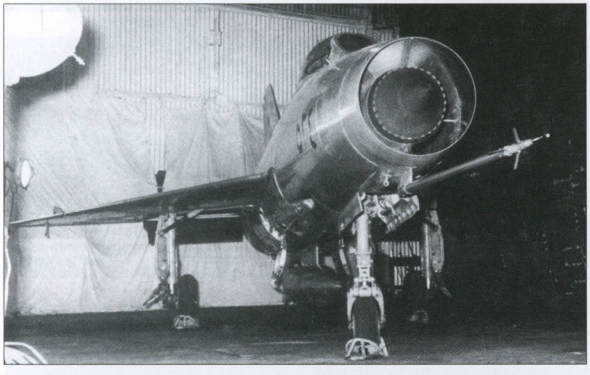
Iraq

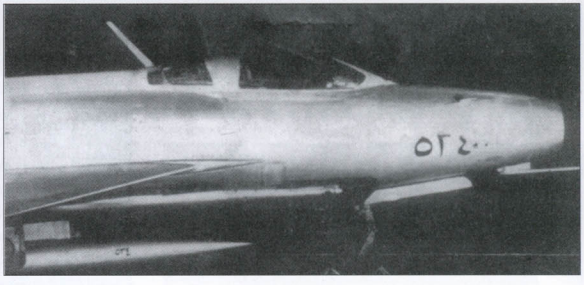
The **Iraqi Air Force** (IrAF, or *al Quwwat al-Jawwiyu al-Iraqiya*) originated as the Royal Iraqi Air Force in 1931, changing its name in 1958 after the overthrow of the King and the formation of a Republic.

The first MiG-21F-13 (*izdeliye* 74) arrived in Iraq in 1963 and ultimately 35 were delivered; known serials are in the range 519-538. The most famous of these was 534 flown by Captain Munir Redfa who defected on 16th August 1966 from el Arîsh airbase, Egypt, to Hatzor, Israel. It was reserialled 007 by its new owners, who shipped it to the USA. Another aircraft carrying the serial 007 replaced it in the Israeli Air Force Museum.

Survivors were withdrawn from service around 1988.

A MiG-21F-13 serialled 709 is preserved at the entrance to Shaibah Air Base. However, the serial is probably spurious as 709 belongs in the

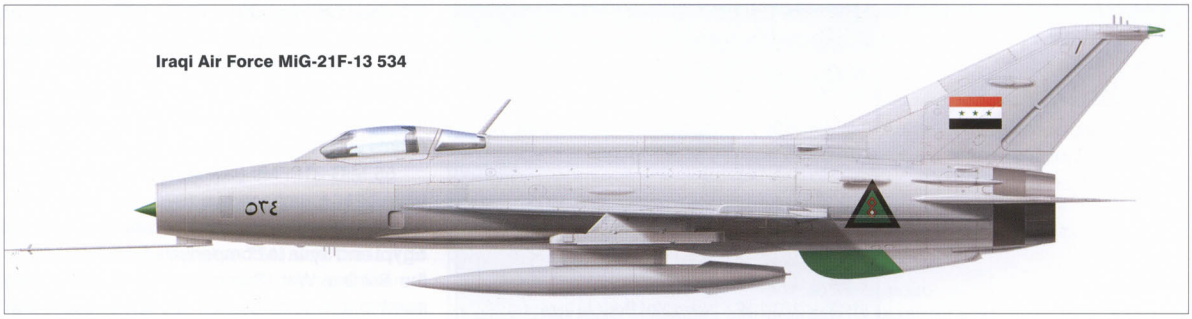




All photos via RART

◄▲

Four views of the Iraqi Air Force MiG-21F-13 '534' delivered to Israel by a defecting pilot in August 1966. Interestingly, the aircraft carries no wing pylons.



Known Iraqi Air Force MiG-21F-13s		
Serial	**Version**	**Comments**
521	MiG-21F-13	Noted on the dump at Al Qadisiyah 2005
522	MiG-21F-13	Noted on the dump at Al Qadisiyah 2005
534	MiG-21F-13	Tested by Israeli Air Force as '007' then despatched to the USA
	MiG-21F-13	Preserved as '007' at the Israeli AF Museum
709	MiG-21F-13	Fake serial? Preserved as gate guard somewhere in Iraq with dummy installation of four AAMs

serial block of MiG-21PFs. It is known that the MiG-21F-13 equipped 11 and 17 Squadrons.

The first delivery of MiG-21PF (*izdeliye* 76A) fighters took place in 1966 and received the serials 539-566; the second delivery occurred in 1967 and was originally serialled 703-734. 37 are known to have been delivered but some sources suggest the figure is nearer 90. 18 aircraft of

An Iraqi MiG-21F-13 captured by Allied troops in the Gulf War. ◄

MiG-21F-13 '709' served as a gate guard at Shaibah airbase. ▼◄

This oddly painted MiG-21F-13 is preserved at Baghdad airport. ▼▼◄

An Iraqi pilot boards a late-model MiG-21PFM serialled 1190. ▼▼▼◄

Early-model MiG-21PFM '21112' (?) captured by US troops. ▼

An early MiG-21PFM used as a gate guard at an Iraqi airbase. ▼▼

All photos via Internet

Known Iraqi Air Force MiG-21PFs		
Serial	**Version**	**Comments**
?	MiG-21PF	Noted 2005 on the dump at al Qadisiyah Air Base
?	MiG-21PF	Noted preserved at Baghdad Airport
1114	MiG-21PF	Noted 2006 derelict Mosul Air Base
... 005	MiG-21PF	Noted 1990 impounded Dresden
... 091	MiG-21PF	Noted 1990 impounded Dresden
... 961	MiG-21PF	Noted 1990 impounded Dresden
21113	MiG-21PF	Noted 2004 Mosul Air Base
21302	MiG-21PF	Noted 1991

9 Squadron served in the Yom Kippur War of 1973 at al Mazzah Air Base, Syria. Many were also sent to help the Egyptian Air Force. Later the IrAF introduced a new five-digit serial system, the first two digits denoting the aircraft type; MiG-21 serials were thus in the 21xxx range.

55 MiG-21PFMs (*izdeliye* 94A) are known to have been purchased in 1970, but many were transferred both before and after delivery to Egypt and Syria to compensate for their losses in the Six-Day War. Some sources state the total number involved was over 100. It is possible that some of these sources have confused the MiG-21PF with the MiG-21PFM.

Known Iraqi Air Force MiG-21PFMs		
Serial	**Version**	**Comments**
82	MiG-21PFM	
681	MiG-21PFM	
21097	MiG-21PFM	Seen derelict minus rear fuselage, location unknown
21112?	MiG-21PFM	Serial obliterated. Captured in damaged condition by Allied forces during Operation Desert Storm
21124	MiG-21PFMa	

An Iraqi Air Force pilot poses with his MiG-21MF. Note the BAC Jet Provosts in the background. ▼

Covered with sand, this Iraqi MiG-21MF serialled 21302 was captured intact during the Gulf War. ►▼

via Internet

via Internet

Known Iraqi Air Force MiG-21MFs				
Serial	**Version**	**C/n**	**Unit**	**Comments**
?	MiG-21MF	96011507		Noted impounded Dresden 11-1990, with Works Job No. 8715
681	MiG-21MF	?	17 Sqn	Fought in Syria 1973, noted at al Hurryiah Air Base 1980
682	MiG-21MF	?	17 Sqn	Fought in Syria 1973, noted at al Hurryiah Air Base 1980
686	MiG-21MF	?		
1184	MiG-21MF	?		Tan/green camouflage
1190	MiG-21MF	?		Tan/green camouflage
21302	MiG-21MF	?		Tan/green camouflage. Photographed in 1992

Serials reported so far are shown in the tables but their authenticity is dubious. This is not casting aspersions on the observers but rather a case of questioning the Iraqi Air Force's motives in using these identifications. The paucity of the quantity of known Iraqi serials is probably the result of the magnitude of the country's aid to its neighbours. However it has been reported that some MiG-21PFM served with 17 Sqn in Syria in 1973 and also against Iran in 1980 with 11 Sqn.

Approximately 15 MiG-21R (*izdeliye* 94RA) reconnaissance aircraft were reported pur-

chased in 1979 and to have served with 70 Squadron but no further details are available.

There is no record of any MiG-21M (izd. 96) delivery to Iraq but 40 MiG-21MFs (izd. 96F) arrived in 1973. They were serialled 657-696, the earlier fighters with these numbers having been sent to Egypt or Syria.

Another batch was purchased in 1979 and is believed to have been numbered 4901-4910.

The MiG-21*bis* (*izdeliye* 75A) was the last of the MiG-21 fighter variants, 61 being delivered from 1983. It is understood that these were numbered in the 211xx and 212xx series. In 1990 it was discovered that some Iraqi aircraft were undergoing overhauls in Dresden, East Germany; four more were found under similar circumstances at Batajnica, Yugoslavia. The numbers given in the table on page 602 imply that further batches of MiG-21*bis* were delivered.

At least ten MiG-21U (*izdeliye* 66-400 and/or *izdeliye* 66-600) trainers were delivered, starting in 1968.

At least eight MiG-21US (*izdeliye* 68A) trainers reportedly arrived in Iraq in 1974, others probably followed. It was certainly the intention of the EGAF (and after 3rd October 1990 the Luftwaffe) to sell surplus MiG-21 trainers to the Iraqi Air Force but the sales fell through and the aircraft impounded probably as a result of Iraq's invasion of Kuwait. One had earlier been allocated an Iraqi serial number. In the table below it is assumed that other aircraft seen at Dresden were Iraqi sent there for an overhaul.

Since all the trainers were serialled in the 21xxx block, is impossible to determine whether a given aircraft in the table is a MiG-21UM or a Chengdu FT-7s without knowing the construction number or seeing a photograph of the aircraft. Ten MiG-21UMs were reported delivered to Iraq from 1983 and given serials in the 210XX range, but 21079 was identified from a photograph as an FT-7.

Known Iraqi Air Force MiG-21*bis* fighters

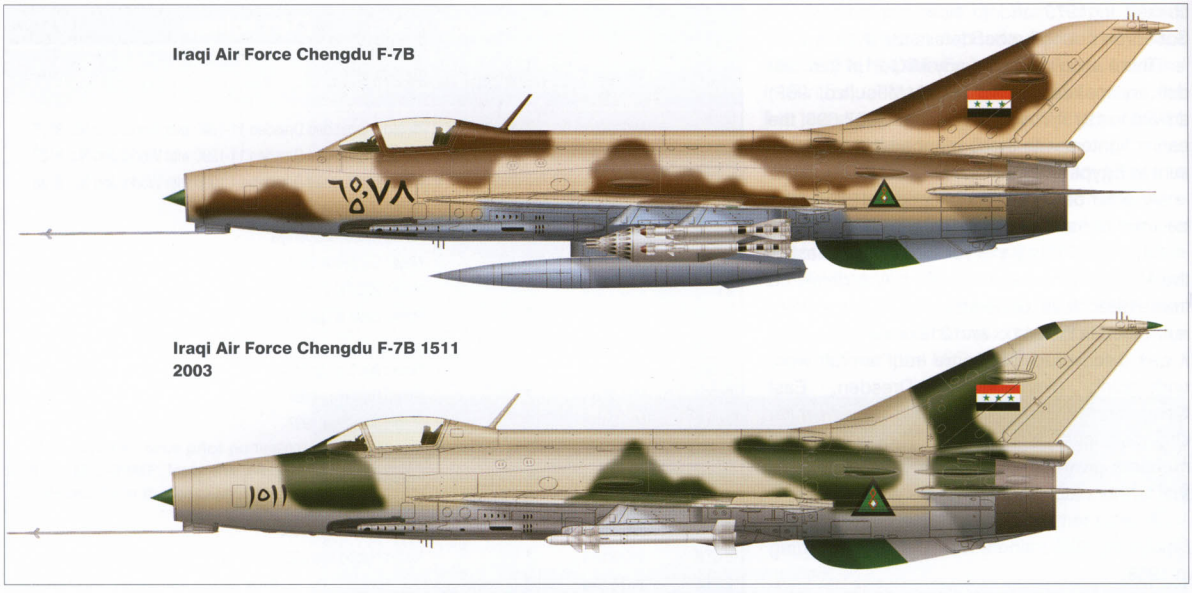
Serial	Version	C/n	Comments
?	MiG-21*bis*	75093067	Noted impounded Dresden 11-1990 with Works Job No. 8136
?	MiG-21*bis*	75070101	Noted impounded Dresden 11-1990 with Works Job No. 8137
?	MiG-21*bis*	75093463	Noted impounded Dresden 11-1990 with Works Job No. 8138
21138	MiG-21*bis*	?	Noted Batajnica 1997
21158	MiG-21*bis*	?	Noted noted Habbaniya
21168	MiG-21*bis*	?	Noted Batajnica 1997
21173	MiG-21*bis*	?	Noted 2003 al Taqqadum
21195	MiG-21*bis*	?	Noted 2003 al Qadisiyah
21196	MiG-21*bis*	?	
21202	MiG-21*bis*	?	Noted 2003 al Qadisiyah
21204	MiG-21*bis*	?	Noted Batajnica 1997
21206	MiG-21*bis*	?	Noted Batajnica 1997
21231	MiG-21*bis*	?	Noted Habbaniya 2005
21233	MiG-21*bis*	?	Noted Habbaniya 2004
21240	MiG-21*bis*	?	Noted Habbaniya 2005 derelict
21250	MiG-21*bis*	?	Noted Habbaniya 2005
21256	MiG-21*bis*	?	Noted Habbaniya 2005
21261	MiG-21*bis*	?	
21285	MiG-21*bis*	?	Reported impounded in Yugoslavia 1998
21286	MiG-21*bis*	?	Reported impounded in Yugoslavia 1997

Iraqi Air Force MiG-21UM 21038 abandoned at al Qadisiyah.
▼◄

The Iraqi Air Force also operated Guizhou FT-7s, exemplified by 21079 derelict at al Qadisiyah.
▼

◄
This Chengdu F-7B is seen derelict at al Qadisiyah in 2003 with the new serial 21607 Black hand-written over the original serial 6578 White.

All photos via Internet



Known Iraqi Air Force MiG-21U trainers			
Serial	**Version**	**C/n**	**Comments**
?	MiG-21U (*izd.* 66-600)	663316	Noted impounded Dresden 1991, ex-EGAF 278 earmarked for sale to Iraq but cancelled
?	MiG-21U (*izd.* 66-600)	664718	Earmarked for sale to Iraq but cancelled

Known Iraqi Air Force MiG-21USs			
Serial	**Version**	**C/n**	**Comments**
?	MiG-21US	05685147	Noted impounded Dresden 11-1990 with Works Job No. 8708
5844	MiG-21US	07685154	Noted impounded Dresden 11-1990 with Works Job No. 8806
?	MiG-21US	04685150	Noted impounded Dresden 11-1990 with Works Job No. 8807

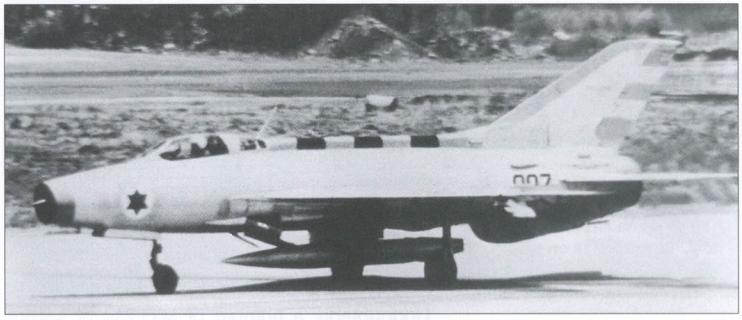
Known Iraqi Air Force MiG-21UMs			
Serial	**Version**	**C/n**	**Comments**
?	MiG-21UM	516969066	Noted impounded Dresden 11-1990, with Works Job No. 8236
?	MiG-21UM	05695155	Noted impounded Dresden 11-1990, with Works Job No. 8237
?	MiG-21UM	516975046	Noted impounded Dresden 11-1990, with Works Job No. 8238
21027	MiG-21UM	?	Noted withdrawn from use in al Qadisiyah
21038	MiG-21UM	?	Tan/green camouflage. Noted withdrawn from use in al Qadisiyah
21040	MiG-21UM	?	Noted withdrawn from use in al Qadisiyah
21045	MiG-21UM	?	Seen in 2006
21057	MiG-21UM	?	Noted withdrawn from use in al Qadisiyah
21068	MiG-21UM	516999436	Noted impounded Dresden 11-1990, with Works Job No. 8235
21072	MiG-21UM	?	
21091	MiG-21UM	?	Tan/brown camouflage. Noted withdrawn from use in Habbaniya

Known Iraqi Air Force F-7Bs		
Serial	**Version**	**Comments**
1511	Chengdu F-7B	Found 2003 in the desert, 150 km south of Bagdhad
6574?	Chengdu F-7B	Reserialled 21603, noted al Qadisiyah 2003
6577?	Chengdu F-7B	Reserialled 21606, noted al Qadisiyah 2003
6578	Chengdu F-7B	Green/brown/tan camouflage. Reserialled 21607, noted derelict al Qadisiyah 2003 with serial 21607 Black hand-written over the original serial
21539	Chengdu F-7B	
21566	Chengdu F-7B	Noted al Qadisiyah 2003
21589	Chengdu F-7B	Green/brown/tan camouflage. Reserialled, former serial unknown; seen derelict

Known Iraqi Air Force FT-7Bs		
Serial	**Version**	**Comments**
21074	Guizhou FT-7B	Noted al Qadisiyah 2003
21078	Guizhou FT-7B	Noted al Qadisiyah c.2003
21079	Guizhou FT-7B	Noted derelict al Qadisiyah 2004
21088	Guizhou FT-7B	Noted al Qadisiyah 2005

Having bought production rights for the MiG-21F-13 (*izdeliye* 74), China considerably developed the type as the Chengdu J-7 for home use and the F-7 for export. In 1982 the Iraqi Air Force received, courtesy of the Egyptian government, 70 F-7B fighters which were initially numbered in the 15XX range. Later they were renumbered in the 215XX and 216XX serial blocks. By the time the squadrons became operational it was too late for them to take on the role of interceptors in the Iran-Iraq War and they were used instead for ground attack.

The two-seat trainer version of the F-7B was named the Guizhou FT-7B and up to 20 were delivered to the Iraqi Air Force around 1982. Unfortunately, some have been incorrectly identified as MiG-21UMs, which is very



via RART

MiG-21F-13 '007' No. 1 undergoing tests in Israel. The spine is black-striped, while the nose and parts of the tail are Dayglo orange.

Israeli Defence Force/Air Force MiG-21F-13 '007' No. 2 in high-visibility test markings
007
MiG-21F-13 '007' No. 2 as preserved in the IDF/AF Museum, Hatzerim ABs
007

Yehuda Borovik archive

via Internet

Serge Batoussov

▲ ▶ **The second Israeli MiG-21F-13 was also serialled '007' but sported a more eyecatching test livery with lots of Dayglo orange.**

via RART

▲ **The same aircraft as it looks now. '007' No. 2 is on display at the IDF/AF Museum in a typical Israeli camouflage scheme.**

confusing, particularly as both variants appear to have their serials jumbled together.

Israel

Undoubtedly a number of MiG-21s of several different subtypes fell into Israeli hands in the series of wars with Egypt, Syria and Iraq in the 1960s and 1970s.The most famous is the MiG-21F-13 serialled 007 (perhaps the Israelis were thinking of James Bond?). There were actually two different aircraft so serialled: the first was the aforementioned Iraqi Air Force '534' surrendered to the Israelis by Captain Munir Redfa, who defected on 16th August 1966, landing at Hatzor AB. The fighter was thoroughly tested by the **Israeli Defence Force/Air Force** (IDF/AF, or *Heyl Ha'Avir*) before being shipped over to America but a second captured example received the same serial (but different markings) and was displayed at the IDF/AF Museum at Hatzerim AB. Originally it wore the original overall silver finish with the addition of Dayglo orange areas to underscore its test status but was later repainted in IDF/AF style camouflage. Six Algerian Air Force MiG-21F-13s on their way to assist the Egyptian Air Force landed in error at an air base recently captured by the Israeli army. Four of these aircraft were sent to America.

There is an unofficial story about the formation of the so-called Soviet Squadron of the IDF/AF. It comprised three former Syrian Air Force MiG-17s, an ex-Egyptian Sukhoi Su-7B and the ex-Iraqi MiG-21F-13 serialled 007. These aircraft were not sent into combat against their former owners but were used to familiarise pilots with these types and to develop tactics to use against them. There may be another spin-off from their capture; it is suggested that their existence caused the Soviets to have second thoughts about sending their latest equipment to an ally who cannot guarantee their security.

Additionally, a MiG-21*bis* (*izdeliye* 75A) bought from Nigeria was used by **Israel Aircraft Industries** (IAI) as an upgrade demonstrator. The silver-painted aircraft wore the IAI logo and the serial 802 on the tail; an unusual feature was the aft-pointing chaff/flare dispensers mounted low on the rear fuselage sides. An ex-Romanian MiG-21MF, 5902 Black (c/n 96005902) was converted as the MiG-21-2000 upgrade demonstrator, receiving an IAI/Elta fire control radar, new cockpit instrumentation and a wraparound birdproof windscreen. The grey-painted aircraft had a red/white striped rudder and carried the Le Bourget exhibit code 252 on the fin along with the serial, plus IAI and Aerostar logos. A similarly converted MiG-21*bis* (*izdeliye* 75B) serialled IAI 304 wore a white/red/black demonstrator livery with IDF/AF insignia.

Laos

After Laos became an independent state in 1953, the *Aviation Laotienne* was formed on 28th January 1955; in August 1960 it was transformed into the Royal Lao Air Force. Caught up in, although not officially involved in the Vietnam War, the withdrawal of US support led to the

Known Lao People's Liberation Army Air Force MiG-21PFMs				
Tactical number	**Version**	**C/n**	**Delivery**	
03	MiG-21PFM	?	c.1976	Stored Xieng Khuang
05	MiG-21PFM	?	c.1976	Stored Xieng Khuang
07	MiG-21PFM	?	c.1976	Stored Xieng Khuang
14	MiG-21MF?	96014024?		
18	MiG-21MF?	?		Possibly MiG-21*bis*
21	MiG-21PFM	?		May be MiG-21MF, stored Vientiane-Wattay
24	MiG-21PFM	?		May be MiG-21MF, stored Vientiane-Wattay
27	?	?		

A pair of Lao People's Liberation Army Air Force MiG-21PFMs.
▼

victory of the Pathet Lao guerrillas and the People's Democratic Republic of Laos was established on 2nd December 1975. The **Lao People's Liberation Army Air Force** (LPLAAF) was quickly formed and ten MiG-21PFM (*izdeliye* 94A) fighters were delivered. Further deliveries took place. None are currently airworthy.

It has been reported that altogether 23 MiG-21PFMs were delivered, receiving the tactical numbers 03-25, although some sources suggest that those numbered 16-25 were MiG-21MFs (*izdeliye* 96F) supplied in 1985.

20 MiG-21*bis* (*izdeliye* 75A) fighters with tactical numbers in the range 26-48 were also reported to have been supplied in 1983 but are not now apparent.

Two MiG-21U (*izdeliye* 66) trainers arrived with the MiG-21PFMs and were followed by a second batch, probably MiG-21UMs (*izdeliye* 69A).

via RART

Freshly overhauled MiG-21*bis* 704 was among the Libyan Arab Republic Air Force aircraft seen at the LAVEX-2007 airshow at Tripoli-Umm Aitiqah.
▼

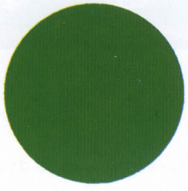
Libya

British and Allied troops drove the Italians and Germans from this Italian colony in 1943. It was then administered by Britain and France (each covering a separate area) on behalf of the United Nations until 24th December 1951 when it became the independent United Kingdom of Libya. It was ruled by King Idris I until September 1969 when, after a *coup d'état*, the military created the Libyan Arab Republic of which Muammar Abu al-Gaddafi became 'Brother, Leader and Guide of the Revolution'. What was previously known as the Royal Libyan Air Force was quickly transformed into *al Quwwat al-Jawwiya al-Arabiya al-Libiya,* which translates as the Libyan Arab Air Force but is usually rendered

Chris Lofting

Known LARAF MiG-21UMs			
Serial	Version	Delivered	Unit
069 *	MiG-21UM		
101	MiG-21UM	c.1975	Force 14
102	MiG-21UM	c.1975	Force 14
103	MiG-21UM	c.1975	Force 14
104	MiG-21UM	c.1975	Force 14
105	MiG-21UM	c.1975	Force 14
106	MiG-21UM	c.1975	Force 14
107	MiG-21UM	c.1975	Force 14
108	MiG-21UM	c.1975	Force 14
109	MiG-21UM	c.1975	Force 14
110	MiG-21UM	c.1975	Force 14
111	MiG-21UM	c.1975	Force 14
112	MiG-21UM	c.1975	Force 14
113 *	MiG-21UM	c.1975	Force 14
114	MiG-21UM	c.1975	Force 14
115	MiG-21UM	c.1975	Force 14
116	MiG-21UM	c.1975	Force 14
117	MiG-21UM	c.1975	Force 14
118	MiG-21UM	c.1975	Force 14
119	MiG-21UM	c.1975	Force 14
120	MiG-21UM	c.1975	Force 14
121	MiG-21UM	c.1975	Force 14
122	MiG-21UM	c.1975	Force 14
123	MiG-21UM	c.1975	Force 14
124	MiG-21UM	c.1975	Force 14
125	MiG-21UM	c.1975	Force 14

* Sand/green/brown camouflage; based Tobruk. Noted at LAVEX-2007 airshow at Tripoli-Mitiga (Umm Aitiqah) AB



MiG-21UM 113, also in three-tone camouflage, was also present at the LAVEX-2007. ▼

as the **Libyan Arab Republic Air Force** (LARAF).

The LARAF authorities did not hold the MiG-21 fighter in high regard because of its short range and low warload, preferring the Dassault Mirage 5, but took delivery in about 1975 of 25 MiG-21UM (*izdeliye* 69A) trainers, serialled 101-125 followed by 50 MiG-21MF (*izdeliye* 96F) fighters serialled 601-650; these figures are disputed as being too high by some sources. Instead of being used operationally by the LARAF, their intended purpose was to train 'Force 14', which was to be the cadre of the new

Chris Lofting

Known LARAF MiG-21MFs			
Serial	Version	Delivered	Unit
601	MiG-21MF	c.1975	Force 14
602	MiG-21MF	c.1975	Force 14
603	MiG-21MF	c.1975	Force 14
604	MiG-21MF	c.1975	Force 14
605	MiG-21MF	c.1975	Force 14
606	MiG-21MF	c.1975	Force 14
607	MiG-21MF	c.1975	Force 14
608	MiG-21MF	c.1975	Force 14
609	MiG-21MF	c.1975	Force 14
610	MiG-21MF	c.1975	Force 14
611	MiG-21MF	c.1975	Force 14
612	MiG-21MF	c.1975	Force 14
613	MiG-21MF	c.1975	Force 14
614	MiG-21MF	c.1975	Force 14
615	MiG-21MF	c.1975	Force 14
616	MiG-21MF	c.1975	Force 14
617	MiG-21MF	c.1975	Force 14
618	MiG-21MF	c.1975	Force 14
619	MiG-21MF	c.1975	Force 14
620	MiG-21MF	c.1975	Force 14
621	MiG-21MF	c.1975	Force 14
622	MiG-21MF	c.1975	Force 14
623	MiG-21MF	c.1975	Force 14
624	MiG-21MF	c.1975	Force 14
625	MiG-21MF	c.1975	Force 14
626	MiG-21MF	c.1975	Force 14
627	MiG-21MF	c.1975	Force 14
628	MiG-21MF	c.1975	Force 14
629	MiG-21MF	c.1975	Force 14
630	MiG-21MF	c.1975	Force 14
631	MiG-21MF	c.1975	Force 14
632	MiG-21MF	c.1975	Force 14
633	MiG-21MF	c.1975	Force 14
634	MiG-21MF	c.1975	Force 14
635	MiG-21MF	c.1975	Force 14
636	MiG-21MF	c.1975	Force 14
637	MiG-21MF	c.1975	Force 14
638	MiG-21MF	c.1975	Force 14
639	MiG-21MF	c.1975	Force 14
640	MiG-21MF	c.1975	Force 14
641	MiG-21MF	c.1975	Force 14
642	MiG-21MF	c.1975	Force 14
643	MiG-21MF	c.1975	Force 14
644	MiG-21MF	c.1975	Force 14
645	MiG-21MF	c.1975	Force 14
646	MiG-21MF	c.1975	Force 14
647	MiG-21MF	c.1975	Force 14
648	MiG-21MF	c.1975	Force 14
649	MiG-21MF	c.1975	Force 14
650	MiG-21MF	c.1975	Force 14

Known LARAF MiG-21*bis* fighters

Serial	Version	Delivered	Unit
701	MiG-21*bis*	c.1980	1060 FR
702	MiG-21*bis*	c.1980	1060 FR
703	MiG-21*bis*	c.1980	1060 FR
704 *	MiG-21*bis*	c.1980	1060 FR
705	MiG-21*bis*	c.1980	1060 FR
706	MiG-21*bis*	c.1980	1060 FR
707	MiG-21*bis*	c.1980	1060 FR
708	MiG-21*bis*	c.1980	1060 FR
709	MiG-21*bis*	c.1980	1060 FR
710	MiG-21*bis*	c.1980	1060 FR
711	MiG-21*bis*	c.1980	1060 FR
712	MiG-21*bis*	c.1980	1060 FR
713	MiG-21*bis*	c.1980	1060 FR
714	MiG-21*bis*	c.1980	1060 FR
715	MiG-21*bis*	c.1980	1060 FR
716	MiG-21*bis*	c.1980	1060 FR
717	MiG-21*bis*	c.1980	1060 FR
718	MiG-21*bis*	c.1980	1060 FR
719	MiG-21*bis*	c.1980	1060 FR
720	MiG-21*bis*	c.1980	1060 FR
721	MiG-21*bis*	c.1980	1060 FR
722	MiG-21*bis*	c.1980	1060 FR
723	MiG-21*bis*	c.1980	1060 FR
724	MiG-21*bis*	c.1980	1060 FR
725	MiG-21*bis*	c.1980	1060 FR
726	MiG-21*bis*	c.1980	1060 FR
727	MiG-21*bis*	c.1980	1060 FR
728	MiG-21*bis*	c.1980	1060 FR
729	MiG-21*bis*	c.1980	1060 FR
730	MiG-21*bis*	c.1980	1060 FR
731	MiG-21*bis*	c.1980	1060 FR
732	MiG-21*bis*	c.1980	1060 FR
733	MiG-21*bis*	c.1980	1060 FR
734	MiG-21*bis*	c.1980	1060 FR
735	MiG-21*bis*	c.1980	1060 FR
736	MiG-21*bis*	c.1980	1060 FR
737	MiG-21*bis*	c.1980	1060 FR
738	MiG-21*bis*	c.1980	1060 FR
739	MiG-21*bis*	c.1980	1060 FR
740	MiG-21*bis*	c.1980	1060 FR
741	MiG-21*bis*	c.1980	1060 FR
742	MiG-21*bis*	c.1980	1060 FR
743	MiG-21*bis*	c.1980	1060 FR
744	MiG-21*bis*	c.1980	1060 FR
745	MiG-21*bis*	c.1980	1060 FR
746	MiG-21*bis*	c.1980	1060 FR
747	MiG-21*bis*	c.1980	1060 FR
748	MiG-21*bis*	c.1980	1060 FR
749	MiG-21*bis*	c.1980	1060 FR
750	MiG-21*bis*	c.1980	1060 FR
751	MiG-21*bis*	c.1980	1060 FR
752	MiG-21*bis*	c.1980	1060 FR
753	MiG-21*bis*	c.1980	1060 FR
754	MiG-21*bis*	c.1980	1060 FR
755	MiG-21*bis*	c.1980	1060 FR
756	MiG-21*bis*	c.1980	1060 FR
757	MiG-21*bis*	c.1980	1060 FR
758	MiG-21*bis*	c.1980	1060 FR
759	MiG-21*bis*	c.1980	1060 FR
760	MiG-21*bis*	c.1980	1060 FR
761	MiG-21*bis*	c.1980	1060 FR
762	MiG-21*bis*	c.1980	1060 FR
763	MiG-21*bis*	c.1980	1060 FR
764	MiG-21*bis*	c.1980	1060 FR
765	MiG-21*bis*	c.1980	1060 FR
766	MiG-21*bis*	c.1980	1060 FR
767	MiG-21*bis*	c.1980	1060 FR
768	MiG-21*bis*	c.1980	1060 FR
769	MiG-21*bis*	c.1980	1060 FR
770	MiG-21*bis*	c.1980	1060 FR
771	MiG-21*bis*	c.1980	1060 FR
772	MiG-21*bis*	c.1980	1060 FR
773	MiG-21*bis*	c.1980	1060 FR
774	MiG-21*bis*	c.1980	1060 FR
775	MiG-21*bis*	c.1980	1060 FR
776	MiG-21*bis*	c.1980	1060 FR
777	MiG-21*bis*	c.1980	1060 FR
778	MiG-21*bis*	c.1980	1060 FR
779	MiG-21*bis*	c.1980	1060 FR
780	MiG-21*bis*	c.1980	1060 FR
781	MiG-21*bis*	c.1980	1060 FR
782	MiG-21*bis*	c.1980	1060 FR
783	MiG-21*bis*	c.1980	1060 FR
784	MiG-21*bis*	c.1980	1060 FR
785	MiG-21*bis*	c.1980	1060 FR
786	MiG-21*bis*	c.1980	1060 FR
787	MiG-21*bis*	c.1980	1060 FR
788	MiG-21*bis*	c.1980	1060 FR
789	MiG-21*bis*	c.1980	1060 FR
790	MiG-21*bis*	c.1980	1060 FR
791	MiG-21*bis*	c.1980	1060 FR
792	MiG-21*bis*	c.1980	1060 FR
793	MiG-21*bis*	c.1980	1060 FR
794	MiG-21*bis*	c.1980	1060 FR

* Sand/green/brown camouflage; noted at LAVEX-2007 airshow at Tripoli-Mitiga AB

Air Force of the proposed Palestinian State once Israel was occupied. Both types were subsequently used in the LARAF but 30 of the MiG-21MFs were sent to Syria in 1982 to replace losses in the air battles with the Israeli Defence Force/Air Force.

An Israeli intelligence report of 3rd April 2006 noted that there were, at that time, 33 MiG-21bis

Libyan Arab Republic Air Force MiG-21*bis* (*izdeliye* 75A) '704'
1060th Fighter Regiment, Tripoli-Umm Aitiqah, 2007

operational with a fighter-bomber regiment plus 25 in storage.

In 2007 the LARAF still had at least one squadron, No. 1021, with MiG-21*bis* fighters and MiG-21UM trainers based at Gamal Abdel Nasser AFB at El Adem near Tobruk; some reports suggest another unit at Okba ben Nafi.

The total number of aircraft listed in the tables below is higher than expected because it was the policy of the LARAF to keep about half their aircraft in storage as attrition replacements or for use as a source for spares.

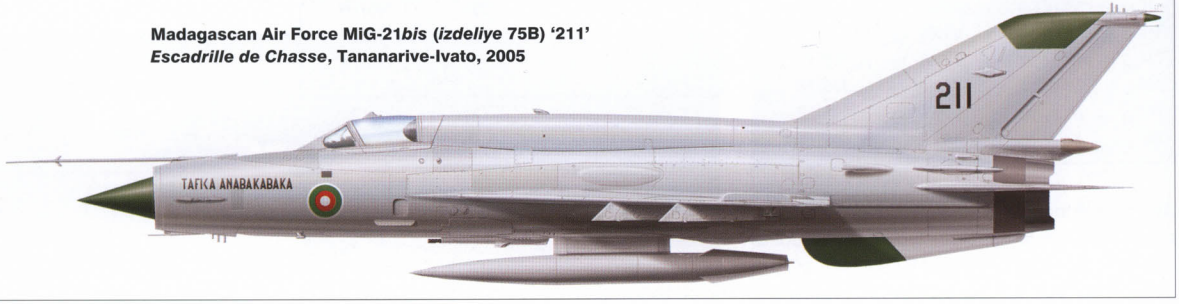
Starting about 1980, the LARAF received 94 (?) MiG-21*bis* (*izdeliye* 75A) fighters to equip three squadrons of its 1060 Fighter Regiment at Gamal Abdel Nasser AB, leaving an adequate number in storage for spares.

All photos by Rocky de Coumar

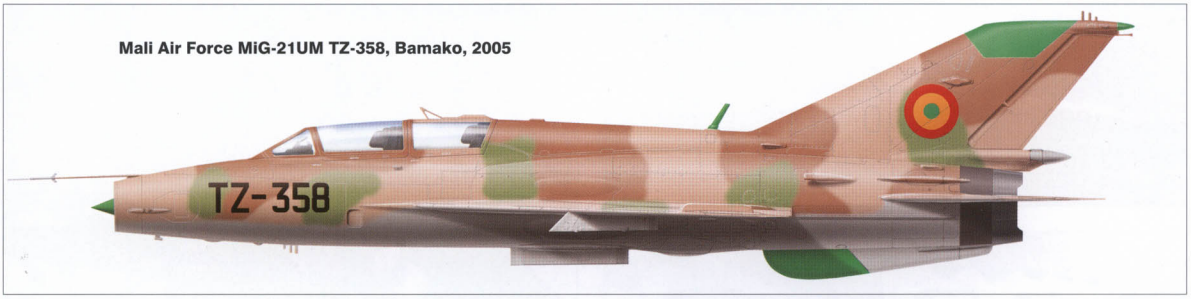
▶ **Madagascan Air Force MiG-21UM '291' and MiG-21*bis* '211' hangared at Ivato AB.**

Known Madagascan Air Force MiG-21s

Serial	Version	Unit	Comments
94	MiG-21MF ?	EdeCh	Noted Ivato 2005
130 Black	MiG-21*bis*	EdeCh	
138 Black	MiG-21*bis*	EdeCh	Silver overall. Derelict Ivato
169 Black	MiG-21*bis*	EdeCh	Noted Ivato 2004
211 Black	MiG-21*bis* (*izd.* 75B)	EdeCh	Noted Ivato 2005. Grey overall, Tafika Anabakabaka titles
233 Black	MiG-21*bis*	EdeCh	Noted Ivato 2005
255 Black	MiG-21*bis*	EdeCh	Grey overall
291 Black	MiG-21UM	EdeCh	Grey overall, Tafika Anabakabaka titles
355 Black	MiG-21UM	EdeCh	



Madagascan Air Force MiG-21*bis* (*izdeliye* 75B) '211'
***Escadrille de Chasse*, Tananarive-Ivato, 2005**



Mali Air Force MiG-21UM TZ-358, Bamako, 2005

An Israeli intelligence report of 3rd April 2006 noted that there were, at that time, 33 MiG-21*bis* operational with a fighter-bomber regiment plus 25 in storage.

Madagascar

Until 1958 Madagascar was a French colony but after independence soon formed, with French assistance, an air transport wing which developed into the *Armée de l'Air Malgache*, or *Tafika Anabakabaka* in the native Malagasy language. A dispute with France in 1975 led to the withdrawal of French troops and aid, the USSR and its allies. stepping into the breach. In 1978 North Korea supplied eight MiG-21PFM (*izdeliye* 94A) fighters and a single MiG-21U trainer and these aircraft together with some MiG-17s formed the *Escadrille de Chasse* (Fighter Squadron, EdeCh) at Tananarive-Ivato. There are unconfirmed reports of MiG-21 deliveries prior to the substantiated arrival of about 12 MiG-21*bis* (*izdeliye* 75B) and at least two MiG-21UMs (*izdeliye* 69A) from the Soviet Union. All surviving MiG-21s were placed in storage about 2000.

Mali

Mali was a French colony until 22nd September 1960. An air arm was formed in 1961 and

All photos via Internet

◄◄ **Mali Air Force MiG-21bis TZ-381 and TZ 385 in storage at Bamako.**

◄ **TZ-358, one of the four known Mali Air Force MiG-21UMs.**

Known Mali Air Force MiG-21s

Serial	Version	C/n	Delivered	Comments
TZ-358	MiG-21UM	?		Tan/green/dark earth camouflage. Noted 12-2005; stored Bamako 2007
TZ-364	MiG-21UM			Noted 2007 stored Bamako
TZ-371	MiG-21*bis* (*izd.* 75B)	?		Dark green/light green/dark earth camouflage. Noted 12-2005; stored Bamako 2007
TZ-372	MiG-21MF			Noted 2007 stored Bamako
TZ-376	MiG-21UM	?		Tan/green/dark earth camouflage. Noted 12-2005
TZ-381	MiG-21*bis* (*izd.* 75B)	?	1974	Tan/green/dark earth camouflage. Noted 1997
TZ-382	MiG-21*bis* (*izd.* 75B)	?		Noted 2007 stored Bamako
TZ-383	MiG-21*bis* (*izd.* 75B)	?		
TZ-384	MiG-21*bis* (*izd.* 75B)	?		
TZ 385	MiG-21*bis* (*izd.* 75B)	?		Tan/green/dark earth camouflage, serial painted with no hyphen. Noted, probably incorrectly, in 1991 as a MiG-21bis
TZ-389	MiG-21*bis* (*izd.* 75B)	?	1974	Noted 1997
?	MiG-21MF*	96005508		Ex-Czech Air Force '5508'
?	MiG-21MF*	96005512		Ex-Czech Air Force '5512'
?	MiG-21UM	516999341		Ex-Czech Air Force '9341'

All photos via Internet

▲ ▶ **Mongolian MiG-21PFMs were usually silver overall, though some were camouflaged and assigned to ground attack.**

developed into the *Force Aérienne de la République du Mali* (FARMA). In 1974 the USSR supplied 12 MiG-21*bis* (*izdeliye* 75B) fighters and two MiG-21UM (*izdeliye* 69A) trainers and in 2005 two MiG-21MFs (Gor'kiy-built examples with MiG-21*bis*-style instrument panels, marked *) and another MiG-21UM arrived from the Czech Republic (see page 609). There may have been other deliveries as there are unconfirmed reports of two more fighters. A USAF mission to Mali reported seeing five MiG-21*bis*, one of which was TZ 385, at Gao Air Base in 1991

Serials were black and surprisingly were prefixed with Mali's civil registration prefix, TZ.

Mongolia

On 24th November 1924 Mongolia became independent and declared itself the Mongolian People's Republic and remained autonomous until Stalin's purges installed his cronies. From 1991 a political vacuum existed until the Mongolian Democratic Coalition Party took over government on 30th June 1996.

An Air Force was formed in May 1925 and was administered by the Army but it soon came under the direct control of the Soviet VVS. The last fighters to be delivered were MiG-21PFMs (*izdeliye* 94A) with the definitive vertical tail and side-hinged canopy in the 1970s and were

Mongolian Air Force MiG-21PFM '007 Red' with the new-style *zoyombo* insignia replacing the earlier stars as shown above

Mongolian Air Force MiG-21PFM '002 Red' with a larger *zoyombo* on the tail

Mongolian Air Force MiG-21PFMs			
Serial	**Type**	**Delivery**	**Comments**
001	MiG-21 PFM	1970s	
002 Red	MiG-21 PFM	1970s	Silver overall
003	MiG-21 PFM	1970s	
004	MiG-21 PFM	1970s	
005	MiG-21 PFM	1970s	
006 White	MiG-21 PFM	1970s	Green/brown camouflage
007 Red	MiG-21 PFM	1970s	Silver overall
008	MiG-21 PFM	1970s	
009 Red	MiG-21 PFM	1970s	Silver overall. Became, see next line
009 White			Light green/dark green/brown camouflage
010 Red	MiG-21 PFM	1970s	Silver overall. Became, see next line
010 White			Green/brown camouflage

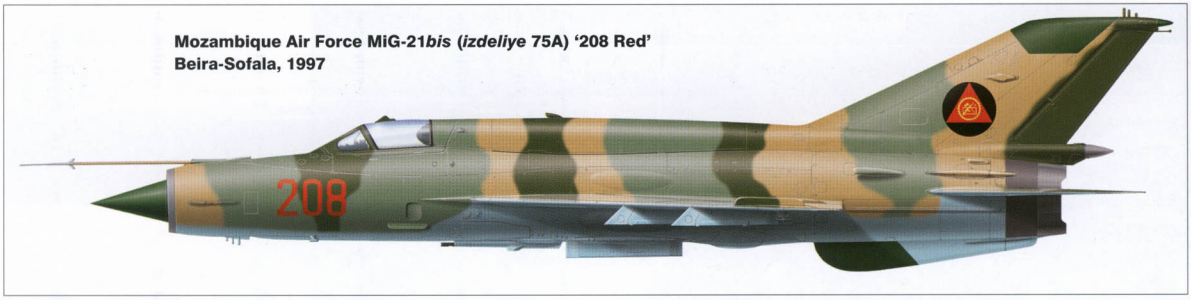
accompanied by a small number of MiG-21 trainers, reported to be MiG-21USs (*izdeliye* 68A). Owing to a shortage of spares and cash all survivors were withdrawn from use in the 1990s and 8-12 fighters and two trainers carefully put into storage at, it is believed, Sainshand Air Base (aka Buyant Ukhaa). There have been no reports of their resurrection.

The MiG-21PFMs were given the tactical codes in the series 001 to 014 but it has not been confirmed whether the MiG-21USs are included. Confirmed codes for fighters taken from photos are: 002, 004, 006, 007, 009 and 010.

There are reports of a MiG-21 of unknown subtype, but likely to be a fighter, preserved and carrying the code 137 at an Ulan Bator Museum.

Known Mozambique Air Force MiG-21*bis*			
Serial	**Version**	**C/n**	**Delivery**
149	MiG-21*bis*	75096782	1982
201	MiG-21*bis*	?	1982
202 Blue	MiG-21*bis*	75095084	1982
203	MiG-21*bis*	75095095	1982
204	MiG-21*bis*	75095103	1982
205	MiG-21*bis*	?	1982
206	MiG-21*bis*	?	1982
207	MiG-21*bis*	75095145	1982
208 Red	MiG-21*bis*	7509....	1982
209	MiG-21*bis*	?	1982
210	MiG-21*bis*	?	1982
211	MiG-21*bis*	?	1982
212	MiG-21*bis*	?	1982
213	MiG-21*bis*	?	1982
214	MiG-21*bis*	?	1982
215	MiG-21*bis*	?	1982
216	MiG-21*bis*	?	1982
217	MiG-21*bis*	?	1982
218	MiG-21*bis*	?	1982
219	MiG-21*bis*	?	1982
220	MiG-21*bis*	?	1982
221	MiG-21*bis*	75096037	1982
222	MiG-21*bis*	75096055	1982
223 Blue *	MiG-21*bis*	?	1982
224	MiG-21*bis*	?	1982
225 Blue *	MiG-21*bis*	?	1982
226	MiG-21*bis*	75096105	1982
227	MiG-21*bis*	75096124	1982
228	MiG-21*bis*	75096176	1982
229	MiG-21*bis*	75096182	1982
230	MiG-21*bis*	?	1982
231 Blue *	MiG-21*bis*	75096189	1982
232	MiG-21*bis*	?	1982
233 *	MiG-21*bis*	?	1982
234	MiG-21*bis*	?	1982
235	MiG-21*bis*	?	1982
236	MiG-21*bis*	?	1982
237	MiG-21*bis*	?	1982
238	MiG-21*bis*	?	1982
239	MiG-21*bis*	?	1982
240	MiG-21*bis*	?	1982
241 Red	MiG-21*bis*	75096524	1982
242	MiG-21*bis*	75096601	1982
243	MiG-21*bis*	?	1982
244	MiG-21*bis*	75096608	1982
245	MiG-21*bis*	75096624	1982
246	MiG-21*bis*	?	1982
247 Blue *	MiG-21*bis* (*izd.* 75B)	?	1982
248	MiG-21*bis*	?	1982

* Noted Beira-Sofala



Mozambique Air Force MiG-21*bis* (*izdeliye* 75A) '208 Red'
Beira-Sofala, 1997

via Internet

▲ **Mozambique Air Force MiG-21*bis* '247' seen at Beira-Sofala airport is definitely the worse for wear, probably having been cannibalised for spares.**

Mozambique

Mozambique gained its independence in 1975 up to which time it had been a colony of Portugal. At first the *Força Popular Aérea* was part of the army but since 1990 it is automonous as *Força Aérea da Moçambique* (Mozambique Air Force, FAM).

It is generally believed that from 1982 a total of 48 MiG-21*bis* (*izdeliye* 75A and 75B) was received complete with Cuban pilots and ground staff and that they were used against the RENAMO guerrilla insurrection; by 1990 only 18 were still in use. The colours of the serials painted on the nose appeared to be left to the discretion of their unit but were mostly in shades of red or blue. After the 1990 ceasefire they were put into storage and neglected. No MiG-21 trainers were ever reported in Mozambique.

It would appear that, with one known exception, the serials were in the range 201-248:

Myanmar

The Union of Burma Air Force was formed on 15th December 1947 and became the **Myanmar Air Force** (MAF, or *Tamdaw Lei*) on 19th June 1989.

In 1990 an order was placed for an initial batch of 12 – ten Chengdu F-7M Airguard interceptors and two Guizhou FT-7 trainers; these arrived at No. 501 Air Base at Hmawbi in early 1991 for 1 Squadron, which was declared operational on 3rd May 1991. A second squadron, whose number is not known, at No. 503 Air Base (Shante, aka Meiktila) received the next batch of twelve (10+2) in 1993. A third batch of 12 (also 10+2) was ordered in 1993 and delivered in 1998-99.

A further order for 30 is reported not to have been completed, either because of a cash shortage or dissatisfaction with the aeroplanes. Whatever the reason, the total F-7M and FT-7 fleet was likely to be 30, probably 24 fighters and six trainers, and two more squadrons were equipped with them: 4 Sqn at Nampong base and 41 Sqn at Mawalamyne. By 1996 at least two examples had been lost in accidents.

Dissatisfaction with the reliability and maintenance cost of these two types led to a contract being placed in 1997 with Elbit for the Israeli company to re-equip 36 existing fighters and trainers with Elta EL/M-2032 interception radar, Litening laser designator pods and also give them the ability to fire Rafael Python 3 air-to-air missiles and drop laser-guided bombs. The contract for 36 refurbishments indicates there were some attrition replacements purchased; some sources suggest 44 fighters and 10 trainers in total were delivered.

To reflect their improved air-to-ground attack ability the modified fighters were redesignated F-7FGA. Since then at least two more have been lost; one F-7FGA crashed on 1st October 2002 near Twante, killing the pilot, and another crashed near Shante AB on 18th August 2004, the pilot ejecting safely.

The current Myanmar Air Force order of battle lists three squadrons with F-7FGA and

Federal Nigerian Air Force MiG-21MF NAF 671

FT-7 aircraft, the unit at Shante now flying MiG-29s.

White serials are carried, the fighters prefixed by 16- followed by a two digit number. Unconfirmed reports state that the FT-7's serials are prefixed by '18-'.

Another order, reported to be 21 F-7Ms, was placed in the late 1990s and delivered from 1999, with more no doubt, to follow.

Known F-7Ms are serialled 16-13, 16-17, 16-19, 16-21 and 16-22, although the intervening serials are also probably used.

There are reports of Russia supplying four MiG-21s in 2001 plus a further 10 in 2002 but these aircraft were, undoubtedly, MiG-29s.

◄ **Five of the twelve Namibian F-7NMs on the flight line at Grootfontein. The fighters were probably serialled 0310 through 0321.**

Namibia

Namibia gained its independence from South Africa on 21st March 1990 and created an Aviation Squadron in its small Defence Force in July 1992 when a Presidential Dassault Falcon 900 was purchased. Subsequently after the acquisition of two, some sources suggest four, MiG-23s from Angola, the **Namibian Air Force** was formed on 13th March 2005; no use seemed to have been made of the MiG-23s. However at least two Gor'kiy-built MiG-21*bis* fighters and one MiG-21UM trainer were delivered after their overhaul and upgrade at IAI in Lod in 2002. Additionally, twelve Chengdu F-7NM fighters (probably serialled consecutively 0310 to 0321) and two Guizhou FT-7NG trainers arrived in late 2006. Known examples are listed in the table.

Nigeria

Nigeria became independent of British rule on 1st October 1960 and in January 1964 the **Federal Nigerian Air Force** (FNAF) was created. The first MiG-21s to be delivered were 25 MiG-21MF (*izdeliye* 96F) fighters and six MiG-21UM (*izdeliye* 69) trainers in 1975. The serial number was stencilled in red on the rear fuselage and the last two digits, also in red, were repeated on the nose. The MiG-21MF fighters were in the series NAF656 to NAF680 and one has been preserved as a gate guard at Abuja Air Base marked as 'NAF693'.

Known Namibian Air Force MiG-21s

Serial	Version	C/n	Delivery	Comments
?	MiG-21bis	75085304	2002	Noted Lod, Israel 4-2002
?	MiG-21bis	75097455	2002	Noted Lod, Israel 4-2002
?	MiG-21UM	516999499?	2002	Noted Lod, Israel 4-2002 same c/n reported for Royal Cambodian AF '7122'!
0310	Chengdu F-7NM	7NM0310?	2006	Based Grootfontein
0313	Chengdu F-7NM	7NM0313?	2006	Based Grootfontein
0315	Chengdu F-7NM	7NM0315?	2006	Based Grootfontein
0319	Chengdu F-7NM	7NM0319?	2006	Based Grootfontein
0321	Chengdu F-7NM	7NM0321?	2006	Based Grootfontein

Known FNAF MiG-21UMs

Serial	Version	Delivered
NAF 650	MiG-21UM	1975
NAF 651 *	MiG-21UM	1975
NAF 652	MiG-21UM	1975
NAF 653	MiG-21UM	1975
NAF 654	MiG-21UM	1975
NAF 655	MiG-21UM	1975

*Crashed 4-11-1981

Known Federal Nigerian Air Force MiG-21MFs

Serial	Version	Delivered	First unit	Comments
NAF 656	MiG-21MF	1975		
NAF 657	MiG-21MF	1975		
NAF 658	MiG-21MF	1975		
NAF 659	MiG-21MF	1975		
NAF 660	MiG-21MF	1975		
NAF 661	MiG-21MF	1975		
NAF 662	MiG-21MF	1975		
NAF 663	MiG-21MF	1975		
NAF 664	MiG-21MF	1975		
NAF 665	MiG-21MF	1975		Crashed 1-3-1978
NAF 666	MiG-21MF	1975		
NAF 667	MiG-21MF	1975		
NAF 668	MiG-21MF	1975		
NAF 669	MiG-21MF	1975		
NAF 670	MiG-21MF	1975		
NAF 671	MiG-21MF	1975	2nd Fighter Regt	Tan/green camouflage
NAF 672	MiG-21MF	1975		Crashed 19-6-1981
NAF 673	MiG-21MF	1975		
NAF 674	MiG-21MF	1975		
NAF 675	MiG-21MF	1975		Crashed 1-10-1976
NAF 676	MiG-21MF	1975		
NAF 677	MiG-21MF	1975		
NAF 678	MiG-21MF	1975		
NAF 679	MiG-21MF	1975		
NAF 680	MiG-21MF	1975		

▶ **A row of Federal Nigerian Air Force MiG-21MFs, including NAF 671, shares the flight line with Aero L-29 Delfin trainers.**

Three have been written off, including NAF651 on 4th November 1981.

In the1990s lack of spares and cash with which to buy them caused all extant MiG-21s to be put into storage. A US survey declared in 2000 that 22 were still there. Plans were put before the government in May 1990 to refurbish and upgrade them but they never reached fruition.

Six second-hand MiG-21UMs (*izdeliye* 69) were also delivered in 1975 and given serials NAF650 to NAF655, probably in black:

However, thanks to increased oil production, money was made available in 2005 for an order to be placed with CAC for 12 Chengdu F-7NI fighters and 3 Guizhou FT-7NI trainers.

A North Korean Air Force pilot climbs into his MiG-21F-13. ▼

Hail to the Chief! This MiG-21PFM is coded '4.15' to denote 15th April, the birthday of the dear North Korean leader Kim Il Sung! ▶▼

North Korea (People's Democratic Republic of Korea)

After the country was liberated from the Japanese, the North was quickly brought into the communist sphere of influence whilst the South looked to the USA for assistance. On 25th June 1950 the North Korean army invaded the South, which, with help from the United Nations, finally repelled the invaders and an uneasy truce was agreed in 1953, which is still holding. The **Korean People's Army Air Force** (KPAAF) was separated from the Army in 1948. The USSR provided aid until 1991, from which time aircraft and other goods were charged at the market price and paid for in hard currency.

With no indigenous aircraft industry, supplies came from the USSR and China. Reliable information from this most secretive of states is not available but it is generally accepted that at least 200 MiG-21 fighter variants, including 30 built in China, were received.

About 80 MiG-21F-13 (*izdeliye* 74) fighters were delivered in 1966-67 and have been noted with red three-digit serials: for example, 302, 304, 711 and 714.

It is known from US Defence Intelligence Agency (DIA) reports that the KPAAF's 1st Fighter Division had one operational squadron of 14 MiG-21F-13s in 1963.

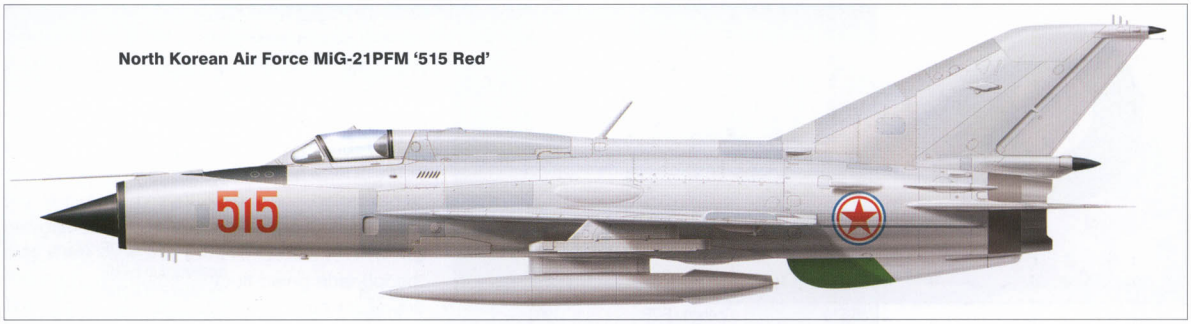
Evidence of MiG-21PFs (*izdeliye* 76) in North Korea is sparse and relies on the correct identification of 401 and 701. It was reported by the US DIA that there were 60 MiG-21s in service in December 1968 and the total for October 1969 was 96, of which 46 were MiG-21PFs and MiG-21PFMs. It is likely that no MiG-21PFs were supplied and that deliveries of 65 in 1968-1971 and 24 in 1974 were entirely the MiG-21PFM (*izdeliye* 94A) variant. Known serials of this variant are: 006, 206, 212, 214, 218, 304, 305, 309, 312, 313, 319, 406, 4.15 (*sic*), 511, 514-515, 604, 705 and 803.

By 1971 there were ten Fighter Regiments with mixed types with each regiment possessing at least one squadron of MiG-21s.

The USSR stopped supplying aircraft to North Korea in 1974 and by 1977 the total of MiG-21s was 120 (as per US DIA). However the USSR agreed to reinstate supplies in 1983, by which time the number of operational MiG-21s had fallen to 50. There are reports that 150 MiG-21MF (*izdeliye* 96F) were delivered in 1985; this total would probably have included some MiG-21PFM fighters.

30 Chinese-built F-7B types were ordered in 1988 and delivered in 1989-1991 (it is possible that some might be FT-7 two-seaters).

All photos via Internet



Examples include 702, 704-706, 711, 714, 720 and 728.

Subsequent deliveries included 38 MiG-21*bis* (*izdeliye* 75A) from Kyrgyzstan in 1999. These aircraft were the remnants from a collection left when that country took over all former Soviet aircraft on its airfields after the dissolution of the USSR in 1991. As more modern types were available the Kyrgyzstan Air Force opted for them and did not take on charge any MiG-21 variants. One noted was numbered 304.

About 50 MiG-21 trainers of several different variants were supplied to North Korea over the years and about 30 are thought to be still in service.

KPAAF Order of Battle 2007 where MiG-21 types are included:

1st Aviation Combat Division:

• 60th Aviation Regiment, Pukchang-West Air Base;

- One squadron with MiG-21 fighters.

2nd Aviation Combat Division

• 56th Aviation Regiment, Toksan AB;

- Three Sqns with F-7B, MiG-21PFM and MiG-21*bis* on charge but not known if the squadrons have a mix of all three.

• 46th Aviation Regiment, Wonsan AB;

- One squadron with MiG-21 fighters.

3rd Aviation Combat Division

• Unknown Aviation Regiment, Hwangju AB;

- 3 squadrons of MiG-21PFMs and MiG-21 trainers

• 86th Aviation Regiment, Koksan Air Base

- 3 squadrons of MiG-21PFMs and MiG-21 trainers

Directly Reporting Regiments:

• Unknown Reconnaissance and Electronics Warfare Regiment operating a mix of many types, including some MiG-21s.

via Internet

▲
North Korean MiG-21PFMs is readied for a night sortie.

Pakistan

The Pakistan Air Force (PAF, or Pakistan Fiza'ya) was formed on 15th August 1947, the day after the formation of the new state. Relations with the USA have alternated between hot and cold and this factor more than any other convinced the Pakistan government to have more than one country as supplier of aircraft. Unlike its neighbour India, it did not develop its own aircraft industry. Unable to buy as many US F-16s of the

Pakistani Air Force F-7MPs belonging to 19 Sqn 'Sherdils' on the flight line at Mianwali AB.
▼

Lindsay Peacock

Known Pakistani Air Force F-7Ps/F-7MPs

Serial	Version	Delivered	First unit	Comments
88-501	Chengdu F-7P	1988		converted to F-7MP
88-502	Chengdu F-7P	1988	20 Sqn	converted to F-7MP, 25 Sqn
88-503	Chengdu F-7P	1988	20 Sqn	converted to F-7MP, 25 Sqn
88-504	Chengdu F-7P	1988	20 Sqn	converted to F-7MP, 25 Sqn
88-505	Chengdu F-7P	1988		converted to F-7MP
88-506	Chengdu F-7P	1988	20 Sqn	converted to F-7MP, 25 Sqn
88-507	Chengdu F-7P	1988	20 Sqn	converted to F-7MP, 25 Sqn
88-508	Chengdu F-7P	1988		converted to F-7MP
88-509	Chengdu F-7P	1988	20 Sqn	converted to F-7MP, 25 Sqn
88-510	Chengdu F-7P	1988	20 Sqn	converted to F-7MP, 25 Sqn
88-511	Chengdu F-7P	1988	20 Sqn	converted to F-7MP, 25 Sqn
88-512	Chengdu F-7P	1988		converted to F-7MP
88-513	Chengdu F-7P	1988	2 Sqn	converted to F-7MP, 25 Sqn
88-514	Chengdu F-7P	1988		
88-515	Chengdu F-7P	1988	20 Sqn	converted to F-7MP, 25 Sqn
88-516	Chengdu F-7P	1988		converted to F-7MP
88-518	Chengdu F-7P	1988	2 Sqn	converted to F-7MP, 25 Sqn
88-520	Chengdu F-7MP	1989		19 (OCU) Sqn
89-521	Chengdu F-7MP	1989		19 (OCU) Sqn
89-523	Chengdu F-7MP	1989		18 (OCU) Sqn
89-525	Chengdu F-7MP	1989		18 (OCU) Sqn
89-530	Chengdu F-7MP	1989	2 Sqn	37 CTW
89-531	Chengdu F-7P	1989		
89-532	Chengdu F-7MP	1989	2 Sqn	
89-533	Chengdu F-7MP	1989		18 (OCU) Sqn
89-534	Chengdu F-7MP	1989		
89-536	Chengdu F-7P	1989		
89-538	Chengdu F-7P	1989		
89-540	Chengdu F-7MP	1989		crashed 30-7-1998
89-543	Chengdu F-7MP	1989		18 (OCU) Sqn
89-544	Chengdu F-7P	1989		
89-546	Chengdu F-7P	1989		
89-547	Chengdu F-7P	1989		
89-548	Chengdu F-7MP	1989		
89-550	Chengdu F-7MP	1989	2 Sqn	
89-551	Chengdu F-7MP	1989		
89-552	Chengdu F-7MP	1989	19 Sqn	
89-553	Chengdu F-7MP	1989		
89-554	Chengdu F-7MP	1989	19 Sqn	
89-556	Chengdu F-7MP	1989	2 Sqn	19 (OCU) Sqn
89-557	Chengdu F-7MP	1989	19 Sqn	
89-558	Chengdu F-7MP	1989	2 Sqn	
89-559	Chengdu F-7MP	1989		
89-560	Chengdu F-7MP	1989		
...-562	Chengdu F-7MP	1989		
90-563	Chengdu F-7MP	1989		
90-565	Chengdu F-7MP	1989		
90-566	Chengdu F-7MP	1989		C/n 7P0325?
90-567	Chengdu F-7MP	1989		
90-568	Chengdu F-7MP	1989		
90-571	Chengdu F-7MP	1989		
90-572	Chengdu F-7MP	1989		
90-574	Chengdu F-7MP	1989		
90-575	Chengdu F-7MP	1989		
90-578	Chengdu F-7MP	1989		
90-579	Chengdu F-7MP	1989		
90-580	Chengdu F-7MP	1989		
93-709?	Chengdu F-7MP			
93-712?	Chengdu F-7MP			
93-719?	Chengdu F-7MP			
93-724	Chengdu F-7MP	1993		400th export F-7
93-730	Chengdu F-7MP	1993		
93-731?	Chengdu F-7MP			

latest type as it required, the PAF in 1988 took delivery of 20 F-7M Airguard fighters as Chengdu F-7Ps, a Chinese development of and vast improvement on the MiG-21F-13. A further 60 were acquired in 1989 together with 15 Guizhou FT-7P two-seat trainers; the second fighter tranche were to a more advanced specification with a revised cockpit layout and better radar; designated F-7MP Skybolt by the manufacturer they were known in the PAF as the F-7P (P for Pakistan), the name Skybolt being abandoned. The first 20 aircraft, quickly brought up to the later specification F-7MP equipped 20 Sqn Cheetahs at Rafiqi which also acted as an Operational Conversion Unit for the type. After a second squadron, 18 Sharp Shooters also at Rafiqi, was created the OCU role was passed to

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25 Sqn Eagles at Mianwali in 1991. Seven of the FT-7P tainers were based at the OCU with the remaining eight shared between the other units. By 1993 Pakistan had operational 18, 20, 25 Squadrons and 'A' Flight at 2 Sqn Minhas at Masroor. In 1993 40 more F-7MP fighters and trainers were ordered. By 2003 F-7Ps equipped 2 Sqn Minhas, 14 Sqn Shaheens, 15 Sqn Cobras, 18 Sqn Talons (OCU), 19 Sqn Warhawks (OCU) and, 20 Sqn Cheetahs.

Black serial numbers were stencilled on the tailfin, the first two digits show the last two digits of the year delivered and the three digits after the hyphen denote the aircraft's number; the latter is repeated on the nose. 88-501 to 88-520 covered the initial delivery and 89-521 to 89-560 and 90-

▲▲ **The delivery ceremony of 93-724, the 400th F-7 for the Pakistani Air Force.**

▲ **FT-7Ps 89-602 and 89-603 represent the Pakistani Air Force's initial trainer version with a short fuselage and no cannon.**

▲◄ **In contrast, FT-7P 90-607 is a late example with a stretched fuselage and a built-in cannon.**

Known Pakistani Air Force FT-7Ps

Serial	Version	Delivery date	First unit	Comments
89-601	Guizhou FT-7P	1989	20 Sqn	25 Sqn. Short fuselage, no cannon
89-602	Guizhou FT-7P	1989	20 Sqn	25 Sqn. Short fuselage, no cannon; sand/green/brown camouflage
89-603	Guizhou FT-7P	1989	20 Sqn	25 Sqn. Short fuselage, no cannon; sand/green/brown camouflage
89-604	Guizhou FT-7P	1989	20 Sqn	25 Sqn
89-605	Guizhou FT-7P	1989	20 Sqn	25 Sqn
89-606	Guizhou FT-7P	1989	20 Sqn	25 Sqn
90-607	Guizhou FT-7P	1990	20 Sqn	25 Sqn, 19 (OCU) Sqn
90-608	Guizhou FT-7P	1990	20 Sqn	25 Sqn,
90-609	Guizhou FT-7P	1990	20 Sqn	25 Sqn
90-610	Guizhou FT-7P	1990	20 Sqn	25 Sqn
90-611	Guizhou FT-7P	1990	20 Sqn	25 Sqn
90-612	Guizhou FT-7P	1990	20 Sqn	25 Sqn
90-613	Guizhou FT-7P	1990	20 Sqn	25 Sqn
90-614	Guizhou FT-7P	1990	20 Sqn	25 Sqn
90-615	Guizhou FT-7P	1990	20 Sqn	25 Sqn
93-653	Guizhou FT-7P	1993	2 Sqn	
93-657	Guizhou FT-7P	1993		19 (OCU) Sqdn
93-659	Guizhou FT-7P	1993		

All photos www.PakistaniDefence.com

▲ A PAF 17 Sqn pilot poses with his mount, F-7PG 01-804.

▶ A trio of 25 Sqn F-7MPs (89-509, 89-514 and 89-515) in echelon port formation.

An F-7PG laden with two missiles and two drop tanks shows off its cranked-delta wings. ▶

561-580 rest of the first two orders. The final F-7P order, placed in 1992, was numbered from 93-701 onwards.

Known Pakistani Air Force F-7PGs

Serial	Version	Delivery date	Comments
01-802	Chengdu F-7PG	2001	
01-804	Chengdu F-7PG	2001	17 Sqdn
01-806	Chengdu F-7PG	2001	17 Sqdn
01-807	Chengdu F-7PG	2001	17 Sqdn
01-808	Chengdu F-7PG	2001	
01-810	Chengdu F-7PG	2001	17 Sqdn
01-811	Chengdu F-7PG	2001	17 Sqdn
01-812	Chengdu F-7PG	2001	17 Sqdn
01-813	Chengdu F-7PG	2001	17 Sqdn
01-814	Chengdu F-7PG	2001	
01-817	Chengdu F-7PG	2001	17 Sqdn
01-818	Chengdu F-7PG	2001	17 Sqdn
01-819	Chengdu F-7PG	2001	
01-820	Chengdu F-7PG	2001	23 Sqdn
02-834	Chengdu F-7PG	2002	23 Sqdn
02-835	Chengdu F-7PG	2002	23 Sqdn
02-842	Chengdu F-7PG	2002	23 Sqdn
02-843	Chengdu F-7PG	2002	
02-845	Chengdu F-7PG	2002	

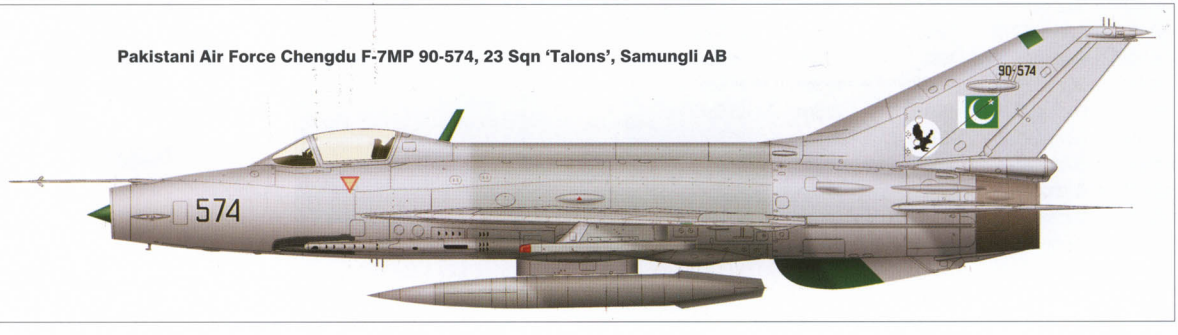
After the first 20 had been brought up to F-7MP standard all the above became known as F-7P.

Fifteen FT-7Ps, the two seat trainer version of the fighter, were delivered in 1989-90 to 20 Sqn with serial numbers 89-601 to 89-606 and 90-607 to 90-615. More deliveries followed in 1990 numbered from 93-651 onwards, of which 93-653 and 93-657 have been noted.

An order for 80 F-7PG (Gai, improved) fighters and FT-7PG trainers was placed in 2001; the F-7PG was developed from the F-7P and has a double-delta wing to improve manoeuvrability and more powerful radar and other avionics. The first tranche of 57 F-7PG and 9 FT-7PG was delivered 2001-2. The serial numbers so far are 01-801 to 01-820 and 02-821 to 02-846. In 2007 the F-7PG equipped 17, 20 and 23 Sqns.

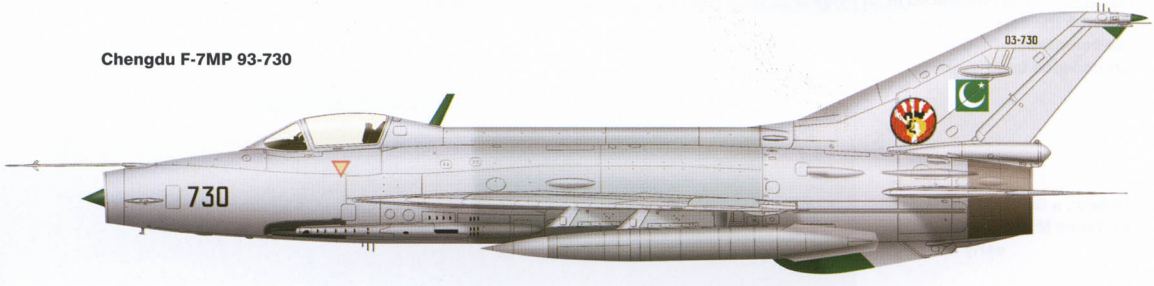
The trainer version of the Chengdu F-7PG fighter was the Guizhou FT-7PG and 11 were delivered to the PAF in 2001-2. One crashed on 13th March 2007.

Pakistani Air Force Chengdu F-7MP 90-574, 23 Sqn 'Talons', Samungli AB

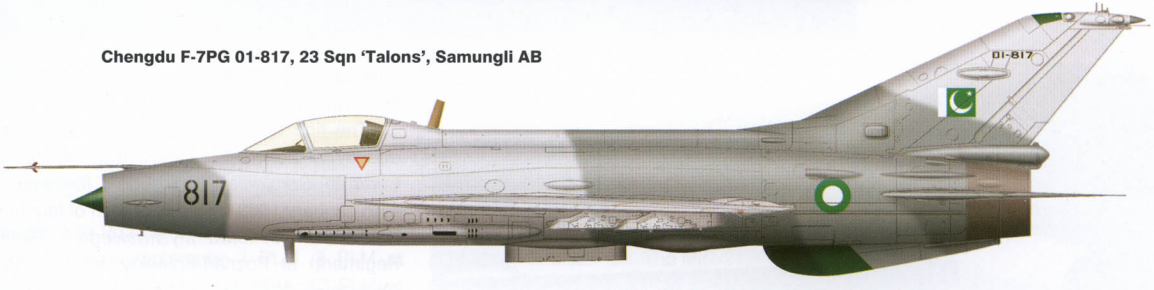


Pakistani Air Force Chengdu F-7P 88-506, 20 Sqn 'Cheetahs', Rafiqi AB

Chengdu F-7MP 93-730

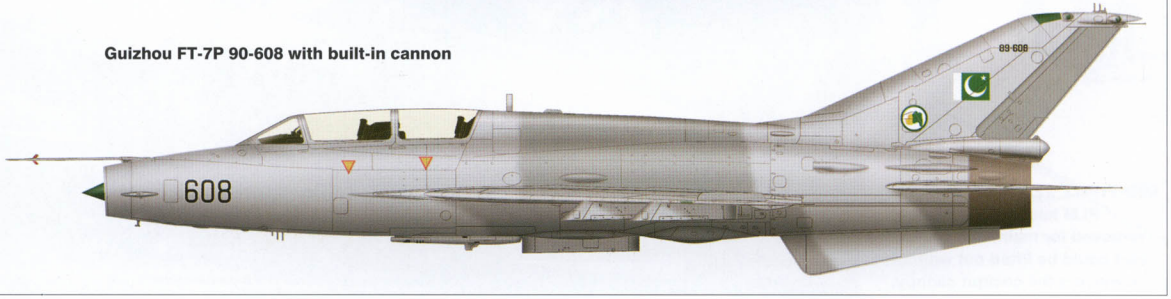


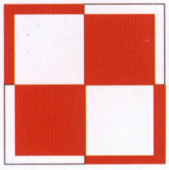
Chengdu F-7PG 01-817, 23 Sqn 'Talons', Samungli AB



Guizhou FT-7P 89-602 without cannon

Guizhou FT-7P 90-608 with built-in cannon





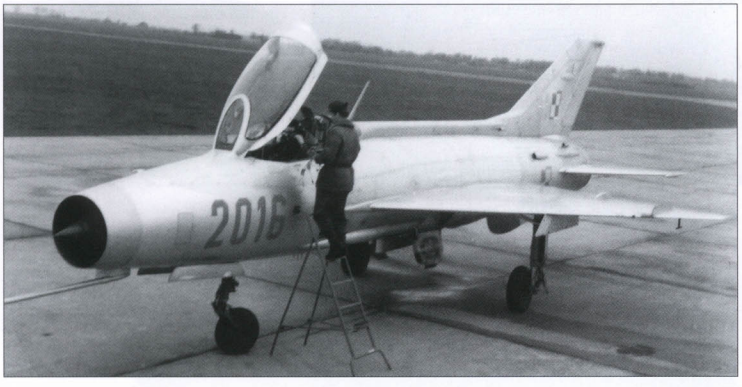
▲ **The current-style *szachownica* (chequerboard) insignia of the Polish Air Force introduced in 1993, with the colours reversed as compared with the earlier *szachownica* used since 1918.**

Poland

The **Polish Air Force** (PWL – *Polskie Wojska Lotnicze*), as it was then called, took delivery of its first MiG-21F-13 (*izdeliye* 74), '1217 Red', on 29th June 1961; a further 24 arrived between 19th September 1962 and 16th September 1963. The first thirteen aircraft delivered were built at *zavod* 21 at Gor'kiy and the final twelve at MMZ No. 30 'Znamya Truda' in Moscow, which had started to build this type in 1962 exclusively for export; the Gor'kiy factory began the changeover to the MiG-21PF in 1961. All were fitted with the late wider-chord fin. Polish Air Force MiG-21s carried red serials, the first one or two digits indicating the production batch number and the final two the number of the aircraft in the batch. As can be seen from the serials, the fighters delivered to Poland were from the 12th, 20th, 22nd and 23rd production batches at Gor'kiy and from the 8th at Moscow.

Waclav Holys

▶ **'2017 Red', a Gor'kiy-built Polish Air Force MiG-21F-13 from an early delivery.**



WAF

▲ **Sister ship '2016 Red' from the same batch. Both aircraft were operated by the CSL (Flight Training Centre) in Modlin.**

The first nine MiG-21F-13s delivered went directly to the training facility at Modlin (CSL – *Centrum Szkolenia Lotniczego*), followed on 11th January 1963 by the despatch of four to 62 PLM (*Pułk Lotnictwa Myśliwskiego* – Fighter Regiment) at Poznań-Krzesiny, six to 1 PLM 'Warszawa' (Warsaw) at Mińsk-Mazowiecki near Warsaw on 14th January 1963 and the final six on 18th January 1963 to 11 PLM (later redesignated 9 PLM) at Dębrzno.

When the more modern MiG-21PF started to arrive in 1964, the MiG-21F-13s were redis-

WAF

▶ **MiG-21F-13 '2223 Red' of the 62. PLM has its ejection seat removed for maintenance. The seat could be lifted out without removing the cockpit canopy.**

Polish Air Force MiG-21F-13s

Serial	Version	C/n	Date of delivery	First Unit	Comments
802	MiG-21F-13	740802	14-1-63	1 PLM	Sold to Syrian AF 10-1973
803	MiG-21F-13	740803	14-1-63	1 PLM	Sold to Syrian AF 10-1973
804	MiG-21F-13	740804	14-1-63	1 PLM	Crashed 13-10-1965
805	MiG-21F-13	740805	14-1-63	1 PLM	
806	MiG-21F-13	740806	14-1-63	1 PLM	Withdrawn from use 3-10-1977 and used as a ground instructional airframe (GIA) Skleczki
807	MiG-21F-13	740807	14-1-63	1 PLM	
808	MiG-21F-13	740808	18-1-63	11 PLM	WFU 3-10-1977 and used as GIA
809 Red	MiG-21F-13	740809	18-1-63	11 PLM	Silver overall. Preserved Aerospace Museum (MLiA – *Muzeum Lotnictwa i Astronautyki*), Kraków
811	MiG-21F-13	740811	18-1-63	11 PLM	
812	MiG-21F-13	740812	18-1-63	11 PLM	
813	MiG-21F-13	740813	18-1-63	11 PLM	
814	MiG-21F-13	740814	18-1-63	11 PLM	Crashed 23-6-1965
1217 Red	MiG-21F-13	N74211217	29-6-61	CSL Modlin	Silver overall. Withdrawn from use 9-7-1969, sold 1994 to Hermeskeil Museum
2007	MiG-21F-13	N74212007	19-9-62	CSL Modlin	Sold to Syrian AF 10-1973
2008	MiG-21F-13	N74212008	19-9-62	CSL Modlin	
2009	MiG-21F-13	N74212009	19-9-62	CSL Modlin	Sold to Syrian AF 10-1973
2015 White	MiG-21F-13	N74212015	21-9-62	CSL Modlin	Light green/dark green/brown camouflage. Preserved Łódź
2016 Red	MiG-21F-13	N74212016	19-9-62	CSL Modlin	Silver overall. Crashed 20-11-1963
2017 Red	MiG-21F-13	N74212017	19-9-62	CSL Modlin	Silver overall.
2018	MiG-21F-13	N74212018	21-9-62	CSL Modlin	
2019	MiG-21F-13	N74212019	21-9-62	CSL Modlin	Sold to Syrian AF 10-1973
2220 Red	MiG-21F-13	N74212220	11-1-63	62 PLM	Silver overall. Withdrawn from use 15-12-1965
2223 Red	MiG-21F-13	N74212223	11-1-63	62 PLM	Silver overall. Sold to Syrian AF 10-1973
2224	MiG-21F-13	N74212224	11-1-63	62 PLM	Sold to Syrian AF 10-1973
2307 Red	MiG-21F-13	N74212307	11-1-63	62 PLM	Silver overall. Withdrawn from use 3-10-1977, preserved *Lubuskie Muzeum Wojskowe*, Drzonów

tributed, with up to four being allocated to each of the following regiments: 1 PLM, 3 PLM at Wrocław-Strachowice AB, 11 PLM, 13 PLM at Łęczyca, 26 PLM at Zęgrze Pomorskie, 40 PLM at Świdwin-Smardzko AB, 41 PLM at Malbork and 62 PLM.

From 1965 all MiG-21F-13 on active duty were centralised at 4 PLM (later redesignated 2 PLM) at Goleniów.

By 1971 the regiment had nineteen on strength but at the end of the same year all had been withdrawn from service. Twelve serviceable MiG-21F-13s were later sold to the Syrian Air Force in October 1973.

The dates against Mierzęcice (the PWL storage depot) in the tables below indicate when the specific aircraft was noted there, not the date of its arrival.

The next version to be mass-produced was the MiG-21PF (*izdeliye* 76), which had no cannon. The Polish Air Force received eighty-four of this variant, the first of these, 2401 Red, arrived on 14th April 1964. Apart from two, which went to CSL Modlin, the new fighters equipped 1 PLM at Mińsk-Mazowiecki, 10 PLM at Łask, 11 PLM (later redesignated 9 PLM) at Dębrzno, 39 PLM at Mierzęcice, 40 PLM at Świdwin, 41 PLM at Malbork and 62 PLM. The MiG-21PF survivors were finally withdrawn from service in December 1989. In the table below the unit referred to is the one to which the aircraft was initially delivered, some serving with 1 and 10 PLM until withdrawn.

40 PLM pilots pose on the flight line at Świdwin with the unit's MiG-21PFs.
▼

WAF

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▲▲ **MiG-21PF '0613 Red' of 1 PLM taxies at Mińsk-Mazowiecki with R-3U acquisition rounds on the pylons. Note the logo of a Polish aircraft repair plant ahead of the stabilator.**

▲ **'1612 Red', another 1 PLM MiG-21PF, has been upgraded to carry the GP-9 cannon pod.**

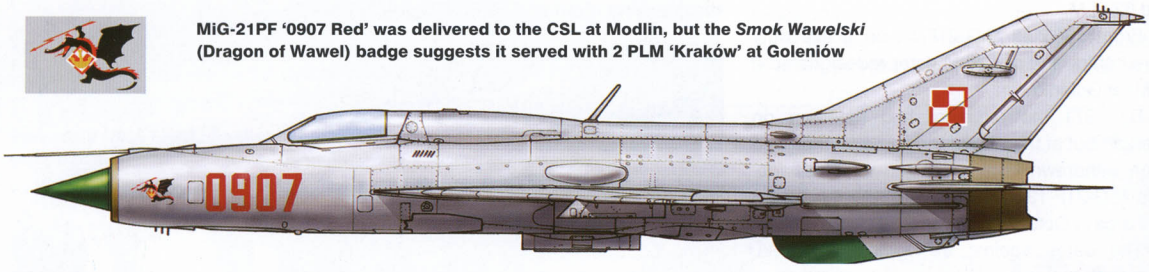
All surviving MiG-21PFs were retired on 11th December 1989. One example became a ground instructional airframe at the CSSTWL (*Centrum Szkolenia Specjalistów Technicznych Wojsk Lotniczych* – Air Force Technical Specialists' Instruction and Training Centre) at Oleśnica.

Altogether, 162 of the next variant, the MiG-21PFM (*izdeliye* 94A and *izdeliye* 94N), were delivered to the Polish Air Force. It was, as previously noted, fitted with blown flaps, a broader tailfin and the new cruciform brake parachute relocated to a housing under the rudder. A new ejection seat, the KM-1, did not use the canopy to protect the pilot after ejection so a new design was used with a fixed windshield and a canopy opening to starboard. Late production batches were able to carry a GP-9 gun pod and the last twelve aircraft delivered were wired to carry a tactical nuclear bomb. To distinguish the nuclear-capable version (known at the OKB as *izdeliye* 94N) it was given the local designation MiG-21PFMN which the Soviet Air Force did not use; the standard version was sometimes unofficially referred to as the MiG-21PFMA, the 'A' reflecting *izdeliye* 94A.

Deliveries began on 4th February 1966 to 40 PLM at Świdwin, followed by 41 PLM at Malbork, 34 PLM at Gdynia-Babie Doly and 26 PLM at Zęgrze Pomorskie but the last twelve went to a naval regiment of the 4 'Pomeranian' *Dywizja Lotnictwa Myśliwskiego* (Fighter Air Division, DLM). The first ten aircraft were built at plant No. 21 in Gor'kiy, the remaining 122 at MMZ No. 30 'Znamya Truda'. In 1971 40 PLM became a fighter-bomber regiment (40 PLM-B – *Pułk Lotnictwa Myśliwsko-Bombowego*) and its 21 MiG-21PFMs were transferred to 2 PLM 'Kraków' based at Goleniów. All surviving MiG-21PFM were withdrawn from service in the mid-1990s.

The twelve nuclear-capable aircraft were at first sent to three regiments – 2 PLM, 9 PLM at Dębrzno and 41 PLM at Malbork, all of them part of 4 'Pomeranian' DLM, but later centralised at 2

MiG-21PF '0907 Red' was delivered to the CSL at Modlin, but the *Smok Wawelski* (Dragon of Wawel) badge suggests it served with 2 PLM 'Kraków' at Goleniów



MiG-21PF '1808 Red' of 1 PLM 'Warszawa', Mińsk-Mazowiecki, with the appropriate *Syrenka* (Little Siren) unit badge

All Polish Air Force side views with unit badges by Wojtek Sankowski

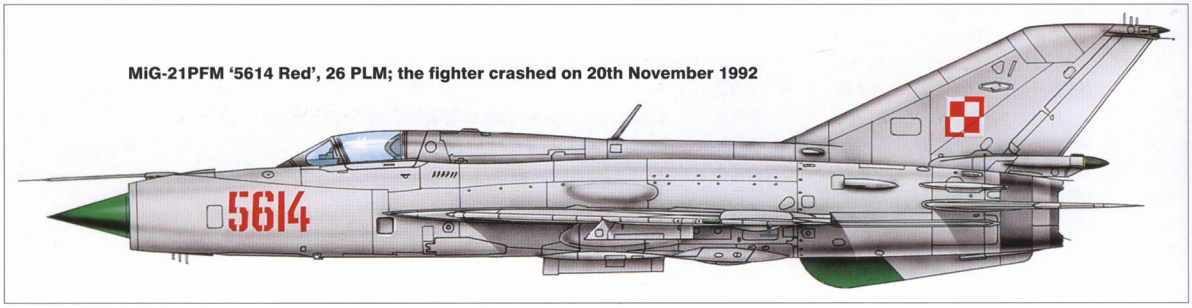
Polish Air Force MiG-21PFs

Serial	Version	C/n	Delivery date	First unit	Comments
411 Red	MiG-21PF	762411?			Photoproof exists; probably to 2411 Red, cf
0607	MiG-21PF	760607	10-12-64	1 PLM	Withdrawn from use 11-12-89
0608	MiG-21PF	760608	10-12-64	1 PLM	Withdrawn 23-3-89 preserved Bydgoszcz
0610	MiG-21PF	760610	10-12-64	1 PLM	Withdrawn from use 1989
0612	MiG-21PF	760612	10-12-64	1 PLM	
0613 Red	MiG-21PF	760613	7-5-64	11 PLM	Silver overall. To 1 PLM. Preserved Jozefów, noted 6-1997
0614	MiG-21PF	760614	7-5-64	11 PLM	
0615 Red	MiG-21PF	760615	7-5-64	11 PLM	Silver overall. Noted preserved Warsaw-Rakowice 3-2005 with 1 PLM badge on nose
0701	MiG-21PF	760701	7-5-64	11 PLM	
0702	MiG-21PF	760702	26-10-64	62 PLM	Scrapped 1-1990
0703	MiG-21PF	760703	26-10-64	62 PLM	Preserved Łask Barracks, noted 2-1993
0704	MiG-21PF	760704	26-10-64	62 PLM	Crashed 14-8-78
0705	MiG-21PF	760705	26-10-64	62 PLM	
0901	MiG-21PF	760901	7-5-64	11 PLM	Silver overall. Preserved as gate guard Gdynia-Babie Doly as '0716 Red'
0902	MiG-21PF	760902	18-1-65	41 PLM	
0903	MiG-21PF	760903	8-1-65	41 PLM	
0905	MiG-21PF	760905	19-1-65	40 PLM	Crashed 11-5-1971, collided with MiG-21U-400 '1219 Red'
0906	MiG-21PF	760906	19-1-65	40 PLM	
0907 Red	MiG-21PF	760907	22-12-64	CSL Modlin	Silver overall, *Smok Wawelski* dragon nose art. WFU 23-3-1989 as GIA at Bydgoszcz, rep. at Buk 10-2004
1506	MiG-21PF	761506	7-1-65	3 PLM	Noted 8-1991 stored Mierzęcice storage depot
1606	MiG-21PF	761606	7-1-65	3 PLM	
1607	MiG-21PF	761607	7-1-65	3 PLM	
1608	MiG-21PF	761608	7-1-65	3 PLM	
1609	MiG-21PF	761609	7-1-65		
1610	MiG-21PF	761610	7-1-65	3 PLM	
1611	MiG-21PF	761611	7-1-65	3 PLM	
1612 Red	MiG-21PF	761612	7-1-65	3 PLM	Silver overall. To 1 PLM
1613	MiG-21PF	761613	7-1-65	3 PLM	
1614 Red	MiG-21PF	761614	7-1-65	3 PLM	Silver overall. To 1 PLM
1615	MiG-21PF	761615	7-1-65	3 PLM	Withdrawn 1990 and preserved Warsaw Military Museum
1701	MiG-21PF	761701	10-7-65	62 PLM	
1702 Red	MiG-21PF	761702	10-7-65	62 PLM	Silver overall. To 1 PLM. Noted 10-2004 preserved Łódź
1703 Red	MiG-21PF	761703	10-7-65	62 PLM	Silver overall. Noted 4-2003 preserved Łódź city
1704	MiG-21PF	761704	10-7-65	62 PLM	
1705	MiG-21PF	761705	10-7-65	62 PLM	Crashed 22-3-1979
1706	MiG-21PF	761706	10-7-65	62 PLM	Noted 3-2005 preserved Hagenbrunn (Gerasdorf), Austria
1707	MiG-21PF	761707	10-7-65	62 PLM	
1708	MiG-21PF	761708	14-7-65	3 PLM	
1709 Red	MiG-21PF	761709	14-7-65	62 PLM	Silver overall.
1710	MiG-21PF	761710	10-7-65	62 PLM	
1711	MiG-21PF	761711	10-7-65	62 PLM	Crashed 23-2-1966
1712	MiG-21PF	761712	14-7-65	3 PLM	
1713	MiG-21PF	761713	29-6-65	40 PLM	Noted 8-1991 stored Mierzęcice
1714 Red	MiG-21PF	761714	10-7-65	62 PLM	Silver overall. Noted 8-1991 stored Mierzęcice
1715	MiG-21PF	761715	10-7-65	62 PLM	
1801	MiG-21PF	761801	6-4-65	26 PLM	Noted 9-2004 preserved Łask as '2000 Red' with *Smok Wawelski* dragon nose art
1802	MiG-21PF	761802	6-4-65	26 PLM	Preserved Warsaw Technical Museum
1803	MiG-21PF	761803	6-4-65	26 PLM	
1804	MiG-21PF	761804	6-4-65	26 PLM	Mierzęcice store 9-1994
1805 Red	MiG-21PF	761805	6-4-65	26 PLM	Silver overall. Preserved, location unknown
1806	MiG-21PF	761806	6-4-65	26 PLM	
1807	MiG-21PF	761807	6-4-65	26 PLM	GIA CSSTWL Oleśnica, noted 5-1994

1808	MiG-21PF	761808	29-6-65	40 PLM	Silver overall. To 1 PLM. Sold to Germany after withdrawal 11-12-1989? (possibly stored Mierzęcice)
1809 Red	MiG-21PF	761809	29-6-65	40 PLM	Silver overall. Preserved Łódź
1810	MiG-21PF	761810	29-6-65	40 PLM	Mierzęcice store 9-1994
1811 Red	MiG-21PF	761811	29-6-65	40 PLM	Silver overall. GIA Bydgoszcz, noted 4-1991 but sold to USA 6-1991 as N21PF
1813 Red	MiG-21PF	761813	29-6-65	40 PLM	Silver overall. Noted 8-1998 stored Mierzęcice
1814 Red	MiG-21PF	761814	18-5-65	41 PLM	Silver overall. Withdrawn from use 1972
1815	MiG-21PF	761815	29-6-65	40 PLM	Preserved Słupsk as '1974 Red'
1901 Red	MiG-21PF	761901	10-7-65	41 PLM	Silver overall. To 1 PLM. Preserved MLiA, Kraków
1902	MiG-21PF	761902	10-7-65	41 PLM	
1903	MiG-21PF	761903	29-6-65	40 PLM	
1904	MiG-21PF	761904	29-6-65	40 PLM	
1911	MiG-21PF	761911	9-8-65	40 PLM	
1913 Red	MiG-21PF	761913	9-8-65	40 PLM	Silver overall. Preserved Chorzów in a funfair
2002 Red	MiG-21PF	762002	9-8-65	40 PLM	An aircraft marked '2002' is preserved at Buk but c/n not confirmed
2003 Red	MiG-21PF	762003	9-8-65	40 PLM	Silver overall.
2004 Red	MiG-21PF	762004	9-8-65	40 PLM	Silver overall. Preserved MLiA, Kraków
2005	MiG-21PF	762005	9-8-65	40 PLM	Noted 8-1998 stored at Mierzęcice
2006	MiG-21PF	762006	6-8-65	26 PLM	
2007	MiG-21PF	762007	6-8-65	26 PLM	
2008	MiG-21PF	762008	6-8-65	26 PLM	Crashed 17-4-1967
2009 Red (1)	MiG-21PF	762009	6-8-65	26 PLM	Silver overall, *Smok Wawelski* dragon nose art. Stored MLiA, Kraków; see MiG-21M table
2010	MiG-21PF	762010	6-8-65	26 PLM	
2401 Red	MiG-21PF	762401	14-4-64	62 PLM	Silver overall. WFU 30-8-1988, preserved *Muzeum imieni Orla Białego* (White Eagle Museum), Skarzysko Kamienna
2402	MiG-21PF	762402	14-4-64	62 PLM	
2403	MiG-21PF	762403	14-4-64	62 PLM	Crashed 22-1-1968
2404	MiG-21PF	762404	14-4-64	62PLM	
2405	MiG-21PF	762405	8-5-64	1 PLM	Crashed 30-6-1966
2406	MiG-21PF	762406	8-5-64	1 PLM	Withdrawn 23-3-1989 as GIA at Bydgoszcz, noted at Schenectady Museum 10-2003
2407	MiG-21PF	762407	8-5-64	1 PLM	
2408	MiG-21PF	762408	8-5-64	1 PLM	Withdrawn 23-3-1989 as GIA at Bydgoszcz
2409	MiG-21PF	762409	7-5-64	11 PLM	Crashed 2-8-1979
2410	MiG-21PF	762410	7-5-64	11 PLM	Sold 5-1991 to Pima Air Museum, AZ, USA as N21MF
2411	MiG-21PF	762411	7-5-64	11 PLM	Withdrawn 23-3-1989 as GIA at Bydgoszcz where noted 3-1995, nose seen at Leeuwarden, Holland, 1-2004
2412 Red	MiG-21PF	762412	24-4-64	CSL Modlin	Silver overall. Withdrawn 23-3-1989 as GIA at Bydgoszcz with all insignia scrubbed out

PLM 'Kraków'. All were withdrawn from service in 1989 and stripped of their nuclear capability, which was just as well, since after storage at Mierzęcice one was sold to a private U.S. citizen in 1994 and registered N221GL.

Developed from the MiG-21PFM, the MiG-21R (*izdeliye* 94RA) reconnaissance aircraft heralded the third generation of the MiG-21. By virtue of its deeper and longer fuselage spine, a greater volume of fuel could be carried. Other changes included various types of reconnaissance pods carried singly under the fuselage, ECM equipment in wingtip fairings and a plain pitot tube offset to starboard on top of the nose; no gun was carried.



MiG-21PFM '5614 Red', 26 PLM; the fighter crashed on 20th November 1992

Waclav Holys

Waclav Holys

▲
MiG-21PFM '6910 Red' of 62 PLM (Sqn 1) wears 1993-style insignia and special colours to mark 40 years of the unit's existence (1954-1994). Note the locally made adapters allowing the fighter to carry four R-3S AAMs instead of two.

◄
MiG-21PFM '5609 Red' was operated by 26 PLM. It is now preserved in Wrocław.

MiG-21PFM '6611 Red' in pre-1993 insignia and with the badge of 26 PLM on the nose.
▼

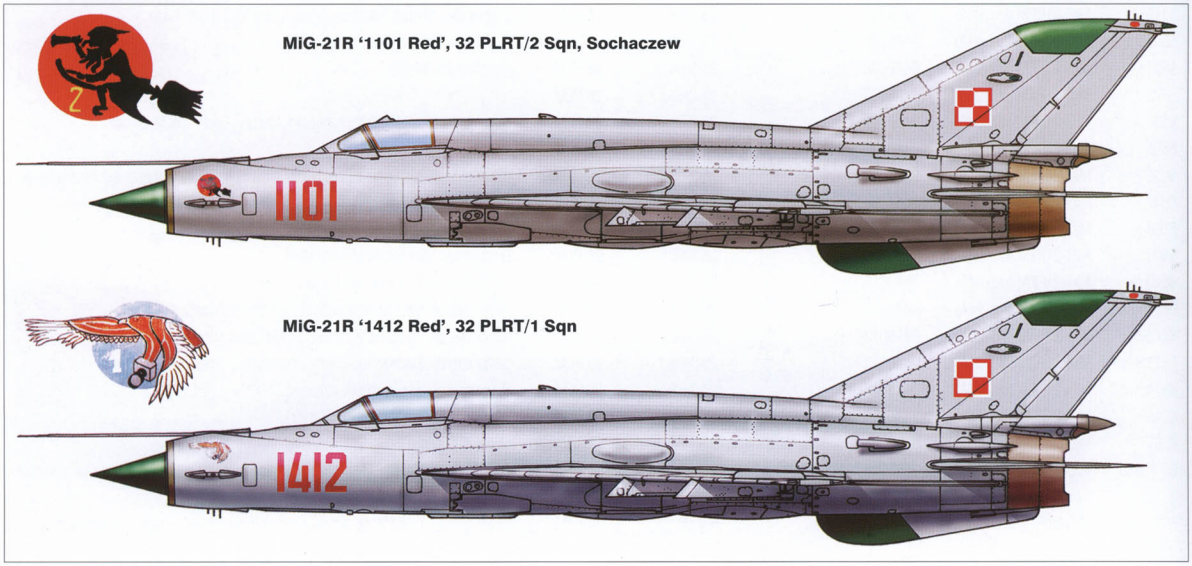
Waclav Holys

Polish Air Force MiG-21PFMs

Serial	Version	C/n	Line number	Date of delivery	First unit	Comments
01 Red	MiG-21PFM (*izd.* 94A)	940ML01	2401	4-2-66	40 PLM	Silver overall. Mierzęcice store 2-1995, preserved MLiA, Kraków
022 Red	MiG-21PFM (*izd.* 94A)	940 MO 22	2322	4-2-66	40 PLM	Silver overall. Noted 12-1995 stored Mierzęcice
03	MiG-21PFM (*izd.* 94A)	940ML03	2403	4-2-66	40 PLM	GIA at CSSTWL Oleśnica, noted 4-1994
04	MiG-21PFM (*izd.* 94A)	940ML04	2404	4-2-66	40 PLM	GIA Warsaw-Bemowo, noted 4-1997, currently stored MLiA, Kraków
05	MiG-21PFM (*izd.* 94A)	940ML05	2405	4-2-66	40 PLM	GIA at CSSTWL Oleśnica, noted 4-1994
06	MiG-21PFM (*izd.* 94A)	940ML06	2406	4-2-66	40 PLM	GIA at CSSTWL Oleśnica 4-1994, preserved Łódź
07	MiG-21PFM (*izd.* 94A)	940ML07	2407	4-2-66	40 PLM	Crashed 23-1-1968
08	MiG-21PFM (*izd.* 94A)	940ML08	2408	4-2-66	40 PLM	
09 Red	MiG-21PFM (*izd.* 94A)	940ML09	2409	4-2-66	40 PLM	Silver overall. Preserved Łódź
10 Red	MiG-21PFM (*izd.* 94A)	940ML10	2410	4-2-66	40 PLM	Silver overall, later dark green/dark earth camouflage. Preserved Łódź, camouflage weathered away
4011	MiG-21PFM (*izd.* 94A)	94A4011		5-8-66	41 PLM	
4012	MiG-21PFM (*izd.* 94A)	94A4012		5-8-66	41 PLM	Mierzęcice store 5-1993
4013 Red	MiG-21PFM (*izd.* 94A)	94A4013		9-8-66	40 PLM	Silver overall. 62 PLM 2-1995
4014	MiG-21PFM (*izd.* 94A)	94A4014		5-8-66	41 PLM	Dismantled Mierzęcice store 5-1993
4015	MiG-21PFM (*izd.* 94A)	94A4015		5-8-66	41 PLM	Mierzęcice store 8-1991
4101	MiG-21PFM (*izd.* 94A)	94A4101		5-8-66	41 PLM	
4102	MiG-21PFM (*izd.* 94A)	94A4102		5-8-66	41 PLM	Mierzęcice store 9-1994, then Geneseo Museum, NY, USA
4103	MiG-21PFM (*izd.* 94A)	94A4103		5-8-66	41 PLM	62 PLM 8-1991
4104 Red	MiG-21PFM (*izd.* 94A)	94A4104		5-8-66	41 PLM	Silver overall. 62 PLM noted 12-1997
4105	MiG-21PFM (*izd.* 94A)	94A4105		5-8-66	41 PLM	Preserved in museum aboard aircraft carrier USS Intrepid, New York
4106	MiG-21PFM (*izd.* 94A)	94A4106		5-8-66	41 PLM	Mierzęcice store 2-1995, preserved Poznań
4107	MiG-21PFM (*izd.* 94A)	94A4107		5-8-66	41 PLM	Mierzęcice store 9-1994, sold to Kalamazoo, USA
4108	MiG-21PFM (*izd.* 94A)	94A4108		5-8-66	41 PLM	Mierzęcice store 5-1993
4109	MiG-21PFM (*izd.* 94A)	94A4109		5-8-66	41 PLM	
4110	MiG-21PFM (*izd.* 94A)	94A4110		5-8-66	41 PLM	Crashed 4-4-1967
4111	MiG-21PFM (*izd.* 94A)	94A4111		5-8-66	41 PLM	Crashed 19-6-1967
4114	MiG-21PFM (*izd.* 94A)	94A4114		5-8-66	41 PLM	
4115	MiG-21PFM (*izd.* 94A)	94A4115		5-8-66	41 PLM	
4201	MiG-21PFM (*izd.* 94A)	94A4201		5-8-66	41 PLM	Mierzęcice store 8-1991
4203	MiG-21PFM (*izd.* 94A)	94A4203		5-8-66	41 PLM	Mierzęcice store 5-1993
4204	MiG-21PFM (*izd.* 94A)	94A4204		5-8-66	41 PLM	Crashed 23-1-1968
4205	MiG-21PFM (*izd.* 94A)	94A4205		5-8-66	41 PLM	GIA Warsaw-Bemowo, currently stored MLiA, Kraków
4206	MiG-21PFM (*izd.* 94A)	94A4206		5-8-66	41 PLM	Mierzęcice store 5-1993
4207	MiG-21PFM (*izd.* 94A)	94A4207		5-8-66	41 PLM	Withdrawn from use 1978
4909	MiG-21PFM (*izd.* 94A)	94A4909		23-1-67	40 PLM	Noted 5-1995 as GIA at CSSTWL Oleśnica
4910	MiG-21PFM (*izd.* 94A)	94A4910		23-1-67	40 PLM	Mierzęcice store 5-1993
4911	MiG-21PFM (*izd.* 94A)	94A4911		23-1-67	40 PLM	Mierzęcice store 5-1993
4912	MiG-21PFM (*izd.* 94A)	94A4912		23-1-67	40 PLM	Mierzęcice store 5-1993, preserved Finsterwalde
4913	MiG-21PFM (*izd.* 94A)	94A4913		23-1-67	40 PLM	Dismantled Mierzęcice store 5-1993
4914	MiG-21PFM (*izd.* 94A)	94A4914		23-1-67	40 PLM	
4915	MiG-21PFM (*izd.* 94A)	94A4915		23-1-67	40 PLM	62 PLM 2-1995
5001 Red	MiG-21PFM (*izd.* 94A)	94A5001		23-1-67	40 PLM	Silver overall, *Smok Wawelski* dragon nose art. Mierzęcice store 9-1994
5002	MiG-21PFM (*izd.* 94A)	94A5002		23-1-67	40 PLM	
5003	MiG-21PFM (*izd.* 94A)	94A5003		23-1-67	40 PLM	Mierzęcice store 5-1993
5004	MiG-21PFM (*izd.* 94A)	94A5004		23-1-67	40 PLM	Mierzęcice store 5-1993
5005	MiG-21PFM (*izd.* 94A)	94A5005		23-1-67	40 PLM	62 PLM 2-1995
5212	MiG-21PFM (*izd.* 94A)	94A5212		15-3-67	34 PLM	Dismantled Mierzęcice store 5-1995
5213	MiG-21PFM (*izd.* 94A)	94A5213		15-3-67	34 PLM	
5214	MiG-21PFM (*izd.* 94A)	94A5214		15-3-67	34 PLM	
5307	MiG-21PFM (*izd.* 94A)	94A5307		15-3-67	34 PLM	62 PLM noted 9-1994
5308	MiG-21PFM (*izd.* 94A)	94A5308		15-3-67	34 PLM	

5309	MiG-21PFM (*izd.* 94A)	94A5309		15-3-67	34 PLM	62 PLM noted 9-1994
5310	MiG-21PFM (*izd.* 94A)	94A5310		15-3-67	34 PLM	Collided with 5611, crashed 31-8-1971
5311	MiG-21PFM (*izd.* 94A)	94A5311		15-3-67	34 PLM	Noted at 1 PLM 5-1993, Mierzęcice store 9-1994
5312 Red	MiG-21PFM (*izd.* 94A)	94A5312		15-3-67	34 PLM	Silver overall. Dismantled Mierzęcice store 5-1993
5313	MiG-21PFM (*izd.* 94A)	94A5313		15-3-67	34 PLM	
5314 Red	MiG-21PFM (*izd.* 94A)	94A5314		15-3-67	34 PLM	Silver overall. 62 PLM 9-1994
5315	MiG-21PFM (*izd.* 94A)	94A315		15-3-67	34 PLM	Dismantled Mierzęcice store 5-1993
5401	MiG-21PFM (*izd.* 94A)	94A5401		15-3-67	34 PLM	Mierzęcice store 2-1995
5402	MiG-21PFM (*izd.* 94A)	94A5402		15-3-67	34 PLM	Crashed 29-9-1967
5403	MiG-21PFM (*izd.* 94A)	94A5403		15-3-67	34 PLM	Mierzęcice store 6-1991
5404	MiG-21PFM (*izd.* 94A)	94A5404		15-3-67	34 PLM	62 PLM noted 8-1991
5405	MiG-21PFM (*izd.* 94A)	94A5405		15-3-67	34 PLM	Dismantled Mierzęcice store 5-1993
5608 Red	MiG-21PFM (*izd.* 94A)	94A5608		2-6-67	26 PLM	Silver overall. 62 PLM 2-1995, later scrapped
5609 Red	MiG-21PFM (*izd.* 94A)	94A5609		2-6-67	26 PLM	Silver overall. GIA at CSSTWL Oleśnica 5-1994, preserved *Kolekcja Lotniczych Zakładów Naukowych*, Wrocław
5610	MiG-21PFM (*izd.* 94A)	94A5610		2-6-67	26 PLM	
5611	MiG-21PFM (*izd.* 94A)	94A5611		2-6-67	26 PLM	Collided with 5310 and crashed 31-8-1971
5612	MiG-21PFM (*izd.* 94A)	94A5612		2-6-67	26 PLM	62 PLM 8-91, nose noted 5-2004 at Best, Holland
5613	MiG-21PFM (*izd.* 94A)	94A5613		2-6-67	26 PLM	
5614	MiG-21PFM (*izd.* 94A)	94A5614		2-6-67	26 PLM	Crashed 20-11-1992
5615	MiG-21PFM (*izd.* 94A)	94A5615		2-6-67	26 PLM	Mierzęcice store 2-1995, preserved Gliwice airfield
5701	MiG-21PFM (*izd.* 94A)	94A5701		24-6-67	26 PLM	Noted at 1 PLM 5-1993, Mierzęcice store 2-1995
5702	MiG-21PFM (*izd.* 94A)	94A5702		24-6-67	26 PLM	Noted at 1 PLM 5-1993, Mierzęcice store 5-1993
5703	MiG-21PFM (*izd.* 94A)	94A5703		24-6-67	26 PLM	Mierzęcice store 5-1993
5704	MiG-21PFM (*izd.* 94A)	94A5704		24-6-67	26 PLM	
5705 Red	MiG-21PFM (*izd.* 94A)	94A5705		24-6-67	26 PLM	Silver overall. 30-8-1990 preserved Łódź without insignia
6507 (1)	MiG-21PFM (*izd.* 94A)	94A6507		25-3-68	26 PLM	Dismantled Mierzęcice store 5-1993; see MiG-21MF table
6508	MiG-21PFM (*izd.* 94A)	94A6508		25-3-68	26 PLM	
6509 Red (1)	MiG-21PFM (*izd.* 94A)	94A6509		25-3-68	26 PLM	Silver overall. Preserved Łódź; see MiG-21MF and MiG-21UM tables
6510 (1)	MiG-21PFM (*izd.* 94A)	94A6510		25-3-68	26 PLM	62 PLM 2-1995, preserved Żarska Wieś; see MiG-21MF table
6511	MiG-21PFM (*izd.* 94A)	94A6511		25-3-68	26 PLM	Noted at 1 PLM 5-1993, 62 PLM 2-1995
6512	MiG-21PFM (*izd.* 94A)	94A6512		25-3-68	26 PLM	Mierzęcice store 5-1993
6513 Red (1)	MiG-21PFM (*izd.* 94A)	94A6513		25-3-68	26 PLM	Silver overall, later dark green/dark earth camouflage. Stored MLiA, Kraków, camouflage weathered away, no insignia
6514	MiG-21PFM (*izd.* 94A)	94A6514		5-4-68	34 PLM	Crashed 23-5-1968
6515 (1)	MiG-21PFM (*izd.* 94A)	94A6515		25-3-68	26 PLM	Dismantled Mierzęcice store 5-1993; see MiG-21MF table
6601	MiG-21PFM (*izd.* 94A)	94A6601		25-3-68	26 PLM	Dismantled Mierzęcice store 5-1993
6602	MiG-21PFM (*izd.* 94A)	94A6602		25-3-68	26 PLM	Crashed 25-2-1980
6603	MiG-21PFM (*izd.* 94A)	94A6603		25-3-68	26 PLM	
6604	MiG-21PFM (*izd.* 94A)	94A6604		25-3-68	26 PLM	Mierzęcice store 5-1993, preserved Warsaw Technical Museum
6605	MiG-21PFM (*izd.* 94A)	94A6605		25-3-68	26 PLM	
6606 Red	MiG-21PFM (*izd.* 94A)	94A6606		25-3-68	26 PLM	Silver overall. Noted at 1 PLM 5-1993, 62 PLM 2-1995, preserved Żarska Wieś
6607	MiG-21PFM (*izd.* 94A)	94A6607		25-3-68	26 PLM	Noted at 1 PLM 5-1993, 62 PLM 2-1995
6608	MiG-21PFM (*izd.* 94A)	94A6608		25-3-68	26 PLM	Noted at 1 PLM 5-1993
6609	MiG-21PFM (*izd.* 94A)	94A6609		25-3-68	26 PLM	Dismantled Mierzęcice store 5-1993
6610	MiG-21PFM (*izd.* 94A)	94A6610		25-3-68	26 PLM	62 PLM 9-1994, preserved Żarska Wieś
6611 Red	MiG-21PFM (*izd.* 94A)	94A6611		25-3-68	26 PLM	Silver overall, later grey overall. Noted stored Modlin 9-1994 & 4-1999
6612 Red	MiG-21PFM (*izd.* 94A)	94A6612		25-3-68	26 PLM	Silver overall. To 62 PLM, noted 2-1995, later scrapped
6613 Red	MiG-21PFM (*izd.* 94A)	94A6613		25-3-68	26 PLM	Silver overall. Dismantled Mierzęcice store 5-1993
6614 Red	MiG-21PFM (*izd.* 94A)	94A6614		25-3-68	26 PLM	Silver overall. Stored MLiA, Kraków
6615	MiG-21PFM (*izd.* 94A)	94A6615		25-3-68	26 PLM	Dismantled Mierzęcice store 5-1993,
6701	MiG-21PFM (*izd.* 94A)	94A6701		25-3-68	CSL Modlin	Mierzęcice store 2-1995
6908 Red	MiG-21PFM (*izd.* 94A)	94A6908		5-4-68	34 PLM	Silver overall. To 62 PLM, noted Adamice 10-2004 without insignia as attraction at Orlen petrol station
6909 Red	MiG-21PFM (*izd.* 94A)	94A6909		5-4-68	34 PLM	Silver overall. To 62 PLM, later scrapped, nose noted 6-2004 Leeuwarden, Holland

6910 Red	MiG-21PFM (*izd.* 94A)	94A6910		5-4-68	34 PLM	Silver overall. To 62 PLM/1 Sqn by 1994, had the unit's 40th anniversary markings with brown stripes on tail that year. Preserved Buk
6911 Red	MiG-21PFM (*izd.* 94A)	94A6911		5-4-68	34 PLM	Silver overall. To 62 PLM 8-1991, preserved Voghera, Italy
6912	MiG-21PFM (*izd.* 94A)	94A6912		5-4-68	34 PLM	Crashed 18-9-1970
6913	MiG-21PFM (*izd.* 94A)	94A6913		5-4-68	34 PLM	Noted at 1 PLM 5-1993, Mierzęcice store 2-1995
6914	MiG-21PFM (*izd.* 94A)	94A6914		5-4-68	34 PLM	62 PLM 2-1995
6915	MiG-21PFM (*izd.* 94A)	94A6915		5-4-68	34 PLM	62 PLM 9-1994, preserved Buk; not present 7-2007
7001	MiG-21PFM (*izd.* 94A)	94A7001		5-4-68	34 PLM	Withdrawn from use 20-10-71
7002	MiG-21PFM (*izd.* 94A)	94A7002		5-4-68	34 PLM	
7011 Red	MiG-21PFM (*izd.* 94A)	94A7011		15-5-68	34 PLM	Silver overall. Noted at 1 PLM 5-1993
7012	MiG-21PFM (*izd.* 94A)	94A7012		15-5-68	34 PLM	62 PLM 9-94, later 3 PLM
7013	MiG-21PFM (*izd.* 94A)	94A7013		15-5-68	34 PLM	Noted dismantled at 1 PLM 5-1993, Mierzęcice store 2-1995
7014	MiG-21PFM (*izd.* 94A)	94A7014		15-5-68	34 PLM	
7015	MiG-21PFM (*izd.* 94A)	94A7015		15-5-68	34 PLM	Mierzęcice store 2-1995, nose noted Bad Vibel, Germany 1997
7101	MiG-21PFM (*izd.* 94A)	94A7101		15-5-68	34 PLM	Noted at 1 PLM 5-1993, 62 PLM 2-1995, Wrocław-Zerenice 9-2002
7102 Red	MiG-21PFM (*izd.* 94A)	94A7102		15-5-68	34 PLM	Silver overall. Noted at 1 PLM 5-1993, 62 PLM 2-1995, preserved Buk; not present 7-2007
7103	MiG-21PFM (*izd.* 94A)	94A7103		15-5-68	34 PLM	Mierzęcice store 8-1991
7809	MiG-21PFM (*izd.* 94N)	94N7809		25-9-68		Finally 2 PLM then stored Mierzęcice before sold in Tulsa, OK, USA 1-1994 as N221GL
7810 Red (1)	MiG-21PFM (*izd.* 94N)	94N7810		25-9-68		Silver overall. Finally 2 PLM, then stored Mierzęcice 5-1993, preserved Warsaw-Mokotów; see MiG-21MF table
7811	MiG-21PFM (*izd.* 94N)	94N7811		25-9-68		Noted at 1 PLM 5-1993, finally 2PLM, then stored Mierzęcice 2-1995
7812	MiG-21PFM (*izd.* 94N)	94N7812		25-9-68		Noted at 1 PLM 5-1993, finally 2 PLM, then noted stored Mierzęcice 2-1995
7813	MiG-21PFM (*izd.* 94N)	94N7813		25-9-68		Finally 2 PLM
7814	MiG-21PFM (*izd.* 94N)	94N7814		25-9-68		Finally 2 PLM, then noted stored Mierzęcice 2-1995
7815 Red	MiG-21PFM (*izd.* 94N)	94N7815		25-9-68		Silver overall. Finally 2 PLM, then stored Mierzęcice 9-1994, preserved *Lubuskie Muzeum Wojskowe*, Drzonów, with GP-9 gun pod
7901	MiG-21PFM (*izd.* 94N)	94N7901		25-9-68		Finally 2 PLM, then stored Mierzęcice 5-1993
7902	MiG-21PFM (*izd.* 94N)	94N7902		25-9-68		Finally 2 PLM, then stored Mierzęcice 2-1995
7903 Red	MiG-21PFM (*izd.* 94N)	94N7903		25-9-68		Silver overall. Finally 2 PLM, then stored Mierzęcice 2-1995
7904	MiG-21PFM (*izd.* 94N)	94N7904		25-9-68		Finally 2 PLM, then stored Mierzęcice 2-1995
7905 Red	MiG-21PFM (*izd.* 94N)	94N7905		25-9-68		Silver overall. Finally 2 PLM, then stored Mierzęcice 5-1993



via RART

Polish Air Force MiG-21Rs

Serial	Version	C/n	Delivery date	First unit	Comments
1064	MiG-21R	94R021064	13-1-72	32 PLRT	Noted 4-2000 stored Poznań
1071	MiG-21R	94R021071	13-1-72	32 PLRT	Noted 4-2000 stored Poznań
1085	MiG-21R	94R021085	26-1-72	32 PLRT	Noted 3 ELT 6-2000
1101	MiG-21R	94R021101	26-1-72	32 PLRT	2 Sqn. Noted 3 ELT 6-2000
1125 Red	MiG-21R	94R021125	13-1-72	32 PLRT	Silver overall. Preserved MLiA, Kraków, with Type R ELINT pod
1139	MiG-21R	94R021139	26-1-72	32 PLRT	Noted Mierzęcice 5-1995
1273 Red	MiG-21R	94R021273	13-1-72	32 PLRT	2 Sqn. Silver overall, bird-scaring eyes. Noted 4-2000 stored Poznań
1311 Red	MiG-21R	94R021311	13-1-72	32 PLRT	Silver overall. Noted 4-2000 stored Poznań
1375	MiG-21R	94R021375	13-1-72	32 PLRT	Noted Mierzęcice 5-1995
1412 Red	MiG-21R	94R021412	13-1-72	32 PLRT	1 Sqn. Noted stored Dęblin 8-1998
1422	MiG-21R	94R01422	28-9-68	41 PLM	Withdrawn from use 22-2-1990, noted stored Poznań 4-2000
1423 Red	MiG-21R	94R01423	28-9-68	41 PLM	2 Sqn. Silver overall, national insignia additionally carried on fuselage. Preserved *Lubuskie Muzeum Wojskowe*, Drzonów, with Type R ELINT pod attached and Type D camera pod displayed alongside
1507	MiG-21R	94R021507	26-1-72	32 PLRT	Noted Mierzęcice 5-1995
1705	MiG-21R	94R01705	5-7-69	21 PLRT	
1706 Red	MiG-21R	94R01706	13-11-69	21 PLRT	Silver overall
1909	MiG-21R	94R01909	16-4-70	21 PLRT	
1911	MiG-21R	94R01911	16-4-70	21 PLRT	
1912	MiG-21R	94R01912	16-4-70	21 PLRT	Noted 4-2000 stored Poznań
1913	MiG-21R	94R01913	16-4-70	21 PLRT	
1914	MiG-21R	94R01914	16-4-70	21 PLRT	
1915	MiG-21R	94R01915	16-4-70	21 PLRT	
1916	MiG-21R	94R01916	16-4-70	21 PLRT	Noted 3 ELT 6-2000
1917	MiG-21R	94R01917	16-4-70	21 PLRT	Noted stored Dęblin 8-1998
2051	MiG-21R	94R022051	13-1-72	32 PLRT	Noted Mierzęcice 5-1995
2089	MiG-21R	94R022089	26-1-72	32 PLRT	
2097 Red	MiG-21R	94R022097	13-1-72	32 PLRT	Silver overall. Noted stored Dęblin 8-1998
2111 Red	MiG-21R	94R022111	26-1-72	32 PLRT	Silver overall. Noted 3 ELT 6-2000
2213	MiG-21R	94R022213	13-1-72	32 PLRT	
2301	MiG-21R	94R022301	26-1-72	32 PLRT	
2355	MiG-21R	94R022355	13-1-72	32 PLRT	Noted Mierzęcice 5-1995
2402	MiG-21R	94R022402	26-1-72	32 PLRT	
2426 Red	MiG-21R	94R022426	13-1-72	32 PLRT	Silver overall. Noted Mierzęcice 5-1995
2503	MiG-21R	94R022503	13-1-72	32 PLRT	
2533	MiG-21R	94R022533	26-1-72	32 PLRT	
2617	MiG-21R	94R022617	13-1-72	32 PLRT	Noted stored Dęblin 8-1998
2657	MiG-21R	94R022657	26-1-72	32 PLRT	Noted Mierzęcice 5-1995

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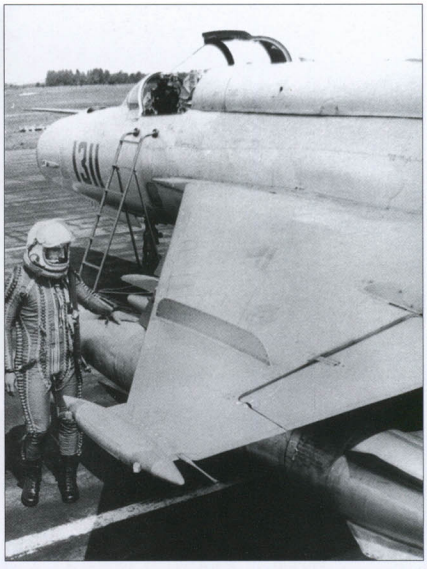

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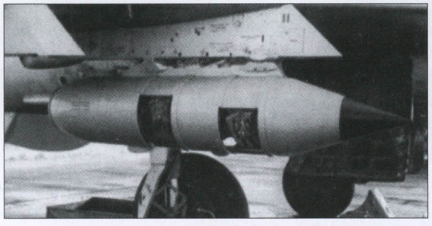
▲ MiG-21R '1423 Red' of 41 PLM fitted with a Type R ELINT pod is unusual in sporting the national insignia on the rear fuselage in addition to the tail.

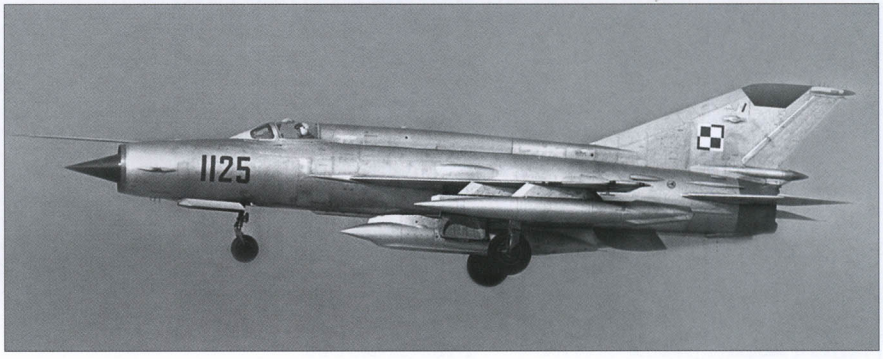


► A Polish-designed Saturn reconnaissance pod based on the UB-16-57UM FFAR pod under the wing of a MiG-21R.

►▲ A 32 PLRT pilot clad for a high-altitude mission prepares for a flight in MiG-21R '1311 Red'.

► MiG-21R '1125 Red' operated by 32 PLRT carries a Type D camera pod.

Previous page: MiG-21R 1273 Red' fitted with a Type R pod wears the badge of the 32 PLRT's 2 Sqn.



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MiG-21M '1813 Red', 2 PLM, Goleniów, 1991

MiG-21M '1904 Red', 1 PLM 'Warszawa', Mińsk-Mazowiecki, 1996
The legend beside the 'Flying Iron' badge reads *33 lata w 1 PLM – pożegnanie MiGów-21* (33 years with the 1st FR – farewell MiG-21s)

Polish Air Force MiG-21Ms					
Serial	Version	C/n	Delivery date	First unit	Comments
1807	MiG-21M	961807	30-12-69	41 PLM	Withdrawn from use 14-12-1978
1808	MiG-21M	961808	30-12-69	41 PLM	Preserved Radom as '04 Red'; tiger marks
1809	MiG-21M	961809	30-12-69	41 PLM	Preserved Kessel, Holland
1810	MiG-21M	961810	30-12-69	41 PLM	2 PLM 5-1991, noted as preserved at Zarnow 9-2002
1811	MiG-21M	961811	30-12-69	41 PLM	Noted stored Mierzęcice 2-1995
1812 Red	MiG-21M	961812	30-12-69	41 PLM	Silver overall. Noted dismantled Mierzęcice 2-1995, preserved Baarlo, Holland
1813 Red	MiG-21M	961813	29-1-70	41 PLM	Silver overall. To 2 PLM. Noted at Nowa Ruda 8-2000
1814	MiG-21M	961814	29-1-70	41 PLM	45 LED, Modlin 9-1994, noted at Buk 8-2004
1815	MiG-21M	961815	20-3-70	41 PLM	Crashed 3-9-1970, remains reported at Presary near Wrocław 4-2003
1901 Red	MiG-21M	961901	2-3-70	9 PLM	Silver overall; had white band on rear fuselage/tail for war game. 2 PLM 5-1991, reported preserved at Biała Podłaska with parts of the airframe painted red and yellow
1902	MiG-21M	961902	2-3-70	9 PLM	Crashed 17-1-1982
1903	MiG-21M	961903	2-3-70	9 PLM	2 PLM 5-1991, preserved Buk
1904 Red	MiG-21M	961904	2-3-70	9 PLM	Silver overall; had white band on rear fuselage/tail for war game. 1 PLM 9-1994, preserved Musée du Château de Savigny (Savigny-lès-Beaune, France), without insignia
1905 Red	MiG-21M	961905	2-3-70	9 PLM	Silver overall, cat nose art. 1 PLM 9-1994
1906	MiG-21M	961906	2-3-70	9 PLM	2 PLM 5-1991, noted stored Malbork 5-1999
1907 Red	MiG-21M	961907	2-3-70	9 PLM	Silver overall. 41 PLM 5-1994, noted 9-2004 preserved in Łódź city as advertising stand
1908	MiG-21M	961908	2-3-70	9 PLM	Crashed 30-7-1978
1909	MiG-21M	961909	2-3-70	9 PLM	2 PLM 5-91, preserved Baarlo, Holland
1910	MiG-21M	961910	2-3-70	9 PLM	2 PLM 5-1991, noted 9-2003 on Nadarzyce Range
1911	MiG-21M	961911	2-3-70	9 PLM	Noted 8-1998 as GIA at CSSTWL Oleśnica
1912 Red	MiG-21M	961912	2-3-70	9 PLM	Silver overall. 2 PLM 5-1991, preserved Nardarzyce Range
1913	MiG-21M	961913	29-1-70	41 PLM	41 PLM 31995, noted 8-1998 stored Dęblin
1914	MiG-21M	961914	29-1-70	41 PLM	1 PLM 9-1994, preserved Baarlo, Holland
1915	MiG-21M	961915	29-1-70	41 PLM	41 PLM 5-1994,
2002	MiG-21M	962002	29-1-70	41 PLM	Preserved Bydgoszcz
2002	MiG-21M	962002	29-1-70	41 PLM	Crashed 31-12-1975
2003	MiG-21M	962003	29-1-70	41 PLM	Noted 12-2006 preserved Kraków
2004	MiG-21M	962004	29-1-70	41 PLM	Withdrawn from use 2-2-1974
2005	MiG-21M	962005	29-1-70	41 PLM	2 PLM 5-1991, reported 6-2004 stored Baarlo, Holland
2006	MiG-21M	962006	29-1-70	41 PLM	
2007	MiG-21M	962007	7-2-70	41 PLM	Preserved Baarlo, Holland
2008 Red	MiG-21M	962008	7-2-70	41 PLM	Silver overall. 10 PLM 3-95, reported 6-2004 stored Baarlo, Holland
2009 Red (2)	MiG-21M	962009	7-2-70	41 PLM	Silver overall. Noted 4-2000 as instructional airframe CSSTWL Oleśnica; see MiG-21PF
2010	MiG-21M	962010	7-2-70	41 PLM	Withdrawn from use 30-5-1977, some sources quote 20-6-1979 for struck off charge
2011	MiG-21M	962011	7-2-70	41 PLM	Crashed 20-6-1979
2012 Red	MiG-21M	962012	7-2-70	41 PLM	Silver overall. Withdrawn from use 3-9-1973

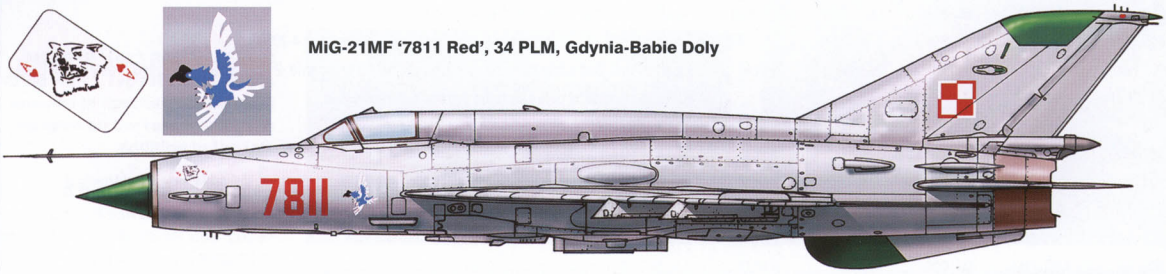
The first delivery comprised two aircraft to 41 PLM on 28th September 1968 but their stay at Malbork was short-lived, ending 10 months later when they moved to the 21 PLRT (*Pułk Lotnictwa Rozpoznania Taktycznego* – Tactical Reconnaissance Aviation Regiment) at Powidź. A further ten examples were received there in April 1970.

The next twenty-four went to 32 PLRT at Sochaczew between 13th and 26th January 1972. All MiG-21Rs were concentrated there when 21 PLRT became a fighter-bomber regiment as 21 PLM-B on 15th February 1983. Those that survived were finally withdrawn from service in 2002.

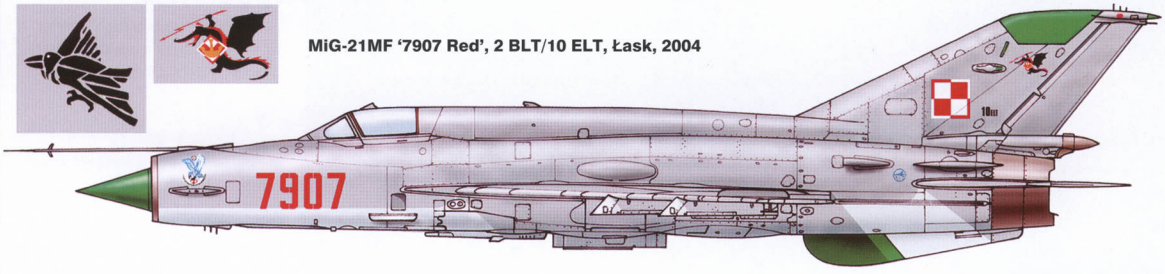
The MiG-21M (*izdeliye* 96) was an export version of the MiG-21SM with the lower-powered R11F2S-300 engine instead of the R13-300 and was assembled only at MMZ No. 30 'Znamya Truda' in Moscow between 1968 and 1971. A batch of six arrived for 41 PLM at Malbork on 30th December 1969, followed by a further 18 in

MiG-21MF '6814 Red', 3 PLM, Wrocław, in special colours to mark the unit's 45th anniversary, Poznan-Krzesiny, 2002

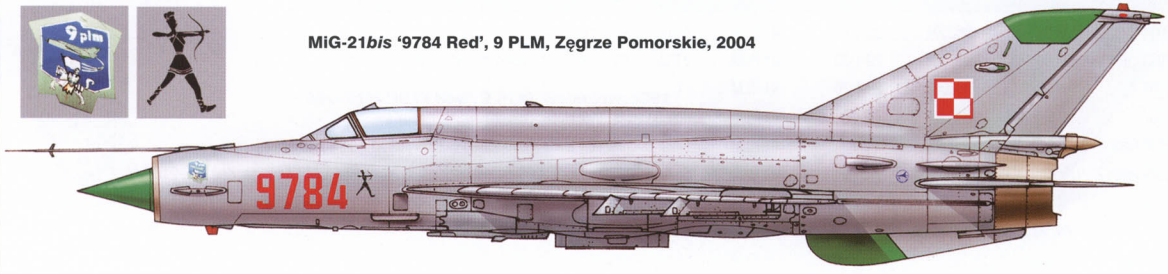
MiG-21MF '7811 Red', 34 PLM, Gdynia-Babie Doly



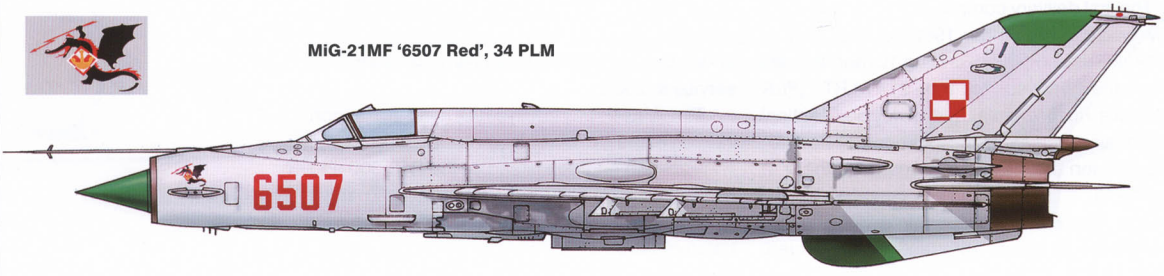
MiG-21MF '7907 Red', 2 BLT/10 ELT, Łask, 2004

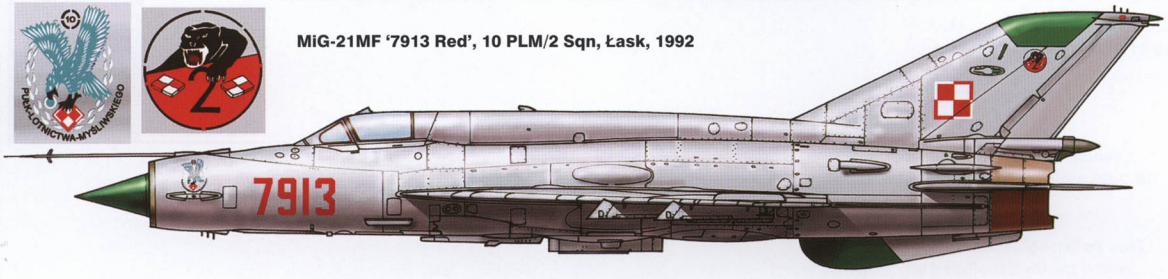


MiG-21*bis* '9784 Red', 9 PLM, Zęgrze Pomorskie, 2004

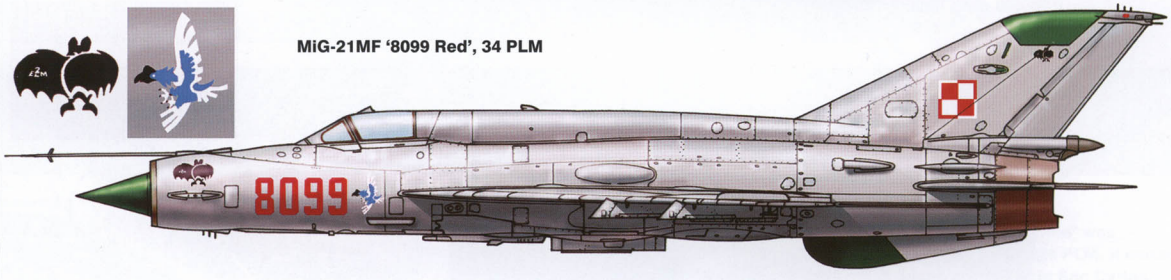


MiG-21MF '6507 Red', 34 PLM

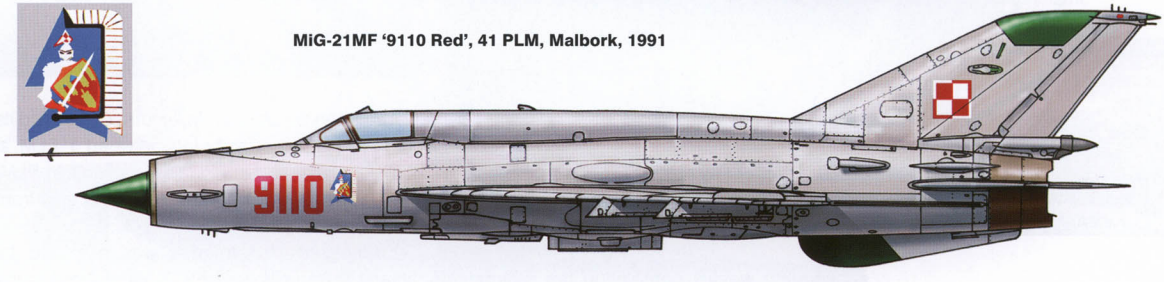




MiG-21MF '7913 Red', 10 PLM/2 Sqn, Łask, 1992

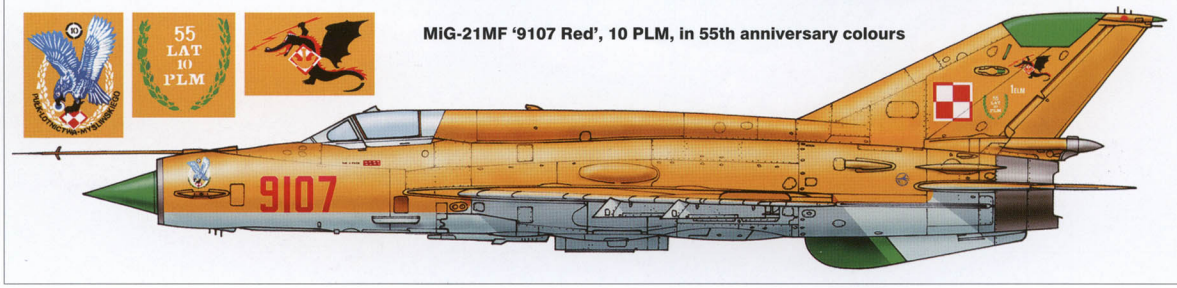


MiG-21MF '8099 Red', 34 PLM



MiG-21MF '9110 Red', 41 PLM, Malbork, 1991

MiG-21MF '09 Black' in the latest NATO camouflage with low-visibility insignia, marked *Szkolny* (instructional)



MiG-21MF '9107 Red', 10 PLM, in 55th anniversary colours

Andrzej Rogucki

MiG-21M '1813 Red' operated by the 41 PLM with an 800-litre drop tank.

A Polish armourer hooks an RS-2-US missile to a MiG-21M.

This Polish MiG-21M is fitted with a locally developed air sampling pod converted from the PTB-490 drop tank.

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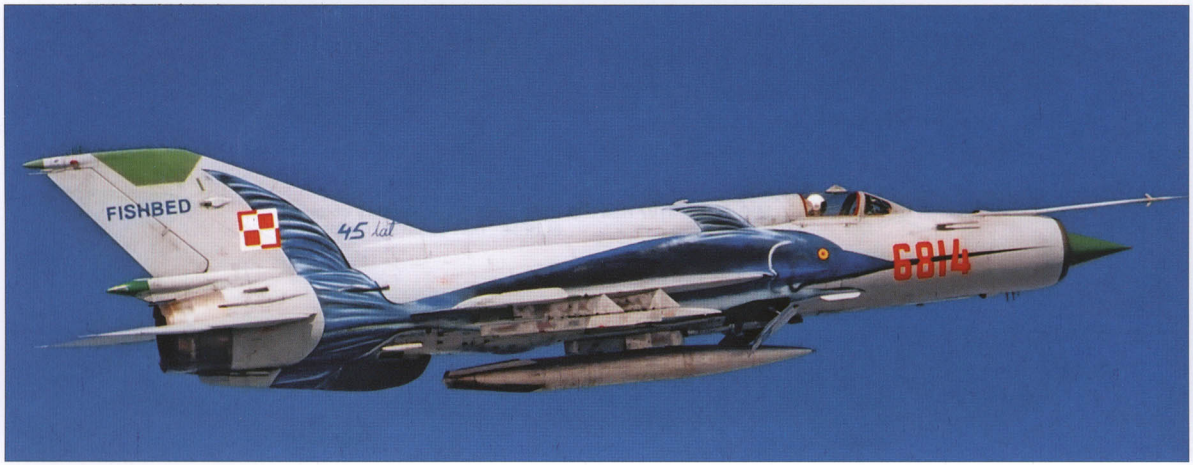
MiG-21M '6814 Red' received this striking special colour scheme with a full-length marlin in 2002 to mark the 45th anniversary of the 3 PLM.

subsequent weeks, completing the regiment's quota by March 1970. Meanwhile, 9 PLM at Dębrzno received twelve aircraft on 2nd March 1970. When this regiment was disbanded towards the end of 1988 its MiG-21Ms were transferred to 2 PLM at Goleniów. In September 1993, when 2 PLM was, in its turn, disbanded its MiG-21Ms were distributed between 1 PLM at Mińsk-Mazowiecki, 10 PLM at Łask and 41 PLM.

All surviving MiG-21M were withdrawn from service in 2002.

Increased performance was achieved by fitting the more powerful R13-300 turbojet to the MiG-21MF (*izdeliye* 96F) variant, which also benefited from having the RP-22 Sapfir-21 radar. Thus the MiG-21MF was the export version of the MiG-21SM used by the Soviet Air Force. Unlike many of the MiG-21Ms, all members of this new



Waclav Holys

Waclav Holys

Waclav Holys

▲
MiG-21MF '8703 Red' was operated by the 26 PLM. It ended up as an exhibit in San Carlos, Brazil, after retirement.

◄
MiG-21*bis* (*izdeliye* 75A) '8855 Red' operated by the Polish Navy's 1 DLMW is shown here in strike configuration with two FFAR pods and two AAMs.

MiG-21MF '9110 Red' is seen at Malbork in 1991 wearing the badge of the resident 41 PLM.
▼

Waclav Holys

Polish Air Force MiG-21MFs

Serial	Version	C/n	Delivery date	First unit	Comments
6503	MiG-21MF	966503	11-12-72	34 PLM	Noted 4-2003 Mierzęcice, later scrapped
6504 Red	MiG-21MF	966504	11-12-72	34 PLM	Silver overall. 10 PLM 3-1995, preserved MLiA, Kraków
6505	MiG-21MF	966505	11-12-72	34 PLM	2 PLM 1990
6506	MiG-21MF	966506	11-12-72	34 PLM	Silver overall; had white band on rear fuselage/tail for war game. Preserved Łask
6507 Red (2)	MiG-21MF	966507	11-12-72	34 PLM	Grey overall, *Smok Wawelski* dragon nose art. Std Mierzęcice 9-1994, sold in Glendale, AZ, USA; see MiG-21PFM
6508	MiG-21MF	966508	11-12-72	34 PLM	
6509 (2)	MiG-21MF	966509	11-12-72	34 PLM	Noted as GIA at CSSTWL Oleśnica 9-2002; see MiG-21PFM and MiG-21UM
6510 Red (2)	MiG-21MF	966510	11-12-72	34 PLM	Grey overall. Preserved Łódź; see MiG-21PFM
6511	MiG-21MF	966511	11-12-72	34 PLM	Crashed 27-7-71
6512 Red	MiG-21MF	966512	11-12-72	34 PLM	Grey overall. To 62 PLM. Dismantled Mierzęcice 2-1995
6513 Red (2)	MiG-21MF	966513	11-12-72	34 PLM	Grey overall, *Smok Wawelski* dragon nose art. Stored Mierzęcice 9-1994; see MiG-21PFM
6514	MiG-21MF	966514	11-12-72	34 PLM	Noted 6-2004 withdrawn from use Łask
6515 Red (2)	MiG-21MF	966515	11-12-72	34 PLM	Grey overall, *Smok Wawelski* dragon nose art. 11 PLM 8-1991, noted 3 PLM 8-1999; see MiG-21PFM
6601	MiG-21MF	966601	11-12-72	34 PLM	3 PLM noted 8-1999
6602	MiG-21MF	966602	11-12-72	34 PLM	GIA at WOSL Dęblin noted 9-2000
6603	MiG-21MF	966603	11-12-72	34 PLM	Front fuselage noted Leeuwarden, Holland, 1-2004
6604	MiG-21MF	966604	11-12-72	34 PLM	Mierzęcice stored noted 5-1995
6715	MiG-21MF	966715	9-3-73	34 PLM	Preserved Łask, noted 9-2004
6804 White outline	MiG-21MF	966804	9-3-73	34 PLM	Stored Mierzęcice 5-1993; returned to service in two-tone grey camouflage
6808	MiG-21MF	966808	9-3-73	34 PLM	10 PLM 3-1995, stored Dęblin 5-1999
6810	MiG-21MF	966810	9-3-73	34 PLM	Noted as instructional airframe Warsaw-Bemowo 4-1997, still present 2007
6812	MiG-21MF	966812	9-3-73	34 PLM	10 PLM 3-1995
6813	MiG-21MF	966813	9-3-73	34 PLM	Stored Mierzęcice, noted 5-1995 but by 9-2007 displayed unmarked at Pyrzowice Airport terminal
6814 Red	MiG-21MF	966814	9-3-73	34 PLM	To 3 PLM, painted with a marlin on each side of the fuselage/tail to celebrate the unit's 45th anniversary 2002; noted WFU Poznań-Krzesiny 10-2004, now preserved Poznań-Kobylnica
7805	MiG-21MF	967805	27-8-73	34 PLM	To 11 PLM, noted 8-1995
7806	MiG-21MF	967806	11-8-73	41 PLM	Crashed 17-5-82
7807	MiG-21MF	967807	11-8-73	41 PLM	To 10 PLM, noted 8-1996
7808	MiG-21MF	967808	11-8-73	41 PLM	Crashed 31-12-1975
7809 White outline	MiG-21MF	967809	11-8-73	41 PLM	Two-tone grey camouflage. Stored Łask 6-2004
7810 Red (2)	MiG-21MF	967810	11-8-73	41 PLM	Grey overall, *Smok Wawelski* dragon nose art. Stored Mierzęcice 2-1995; see MiG-21PFM
7811 Red	MiG-21MF	967811	11-8-73	34 PLM	To 11 PLM, noted 9-1994
7812 Red	MiG-21MF	967812	11-8-73	41 PLM	Grey overall. Noted Poznań withdrawn from use 10-2004
7813	MiG-21MF	967813	11-8-73	41 PLM	Crashed 12-8-1975
7814 Red	MiG-21MF	967814	11-8-73	41 PLM	Grey overall. Stored Łask 6-2004
7815 Red	MiG-21MF	967815	11-8-73	41 PLM	Silver overall. Scrapped Babimost 10-2004
7901 Red	MiG-21MF	967901	27-8-73	34 PLM	Grey overall, *Smok Wawelski* dragon nose art. Dismantled Mierzęcice 2-1995
7902	MiG-21MF	967902	18-8-73	34 PLM	Preserved Buk
7903	MiG-21MF	967903	18-8-73	34 PLM	Stored Mierzęcice 2-1995
7904	MiG-21MF	967904	18-8-73	34 PLM	
7905	MiG-21MF	967905	25-8-73	41 PLM	Crashed 20-9-1977
7906 Red	MiG-21MF	967906	11-8-73	41 PLM	Grey overall. Stored Łask 1-2003
7907 Red	MiG-21MF	967907	11-8-73	34 PLM	Grey overall, *Smok Wawelski* dragon tail art. Stored Łask 6-2004
7908	MiG-21MF	967908	11-9-73	34 PLM	Noted as GIA at CSSTWL Oleśnica 5-1995
7909 Red	MiG-21MF	967909	24-8-73	41 PLM	Silver overall. To 62 PLM, stored Mierzęcice 2-1995
7910	MiG-21MF	967910	27-8-73	34 PLM	
7911	MiG-21MF	967911	27-8-73	34 PLM	To 10 PLM, noted 3-1995, noted withdrawn from use Łask 6-2004
7912	MiG-21MF	967912	27-8-73	34 PLM	To 10 PLM, noted 10-1997
7913	MiG-21MF	967913	11-9-73	34 PLM	To 10 PLM, noted 10-1997
7914	MiG-21MF	967914	11-9-73	34 PLM	Dismantled Mierzęcice 5-1993

7915	MiG-21MF	967915	11-9-73	34 PLM	Crashed 29-11-1983
8001 Red	MiG-21MF	968001	18-9-73	28 PLM	Silver overall
8002 Red	MiG-21MF	968002	18-9-73	28 PLM	Silver overall. Dęblin stored noted 5-1999
8003 Red	MiG-21MF	968003	18-9-73	28 PLM	Silver overall. To 10 ELT noted 9-2000
8004	MiG-21MF	968004	18-9-73	28 PLM	Noted 2-2004 Chaudfontaine, Belgium
8005	MiG-21MF	968005	18-9-73	28 PLM	To 11 PLM noted 6-1991
8006	MiG-21MF	968006	18-9-73	28 PLM	
8007	MiG-21MF	968007	18-9-73	28 PLM	Preserved Strachowice, noted 4-2003
8008	MiG-21MF	968008	18-9-73	28 PLM	Noted 1-999 preserved Auckland, NZ
8009	MiG-21MF	968009	18-9-73	28 PLM	To 11 PLM, noted 6-1991; stored Łask 6-2004
8010	MiG-21MF	968010	11-9-73	34 PLM	Stored Dęblin, noted 8-1998
8011 Red	MiG-21MF	968011	11-9-73	34 PLM	Stored Dęblin, noted 5-1999
8012	MiG-21MF	968012	11-9-73	34 PLM	To 10 PLM noted 10-1997
8013	MiG-21MF	968013	11-9-73	34 PLM	To 11 PLM noted 6-1991
8014	MiG-21MF	968014	11-9-73	34 PLM	Stored Dęblin, noted 5-1999
8015 (1)	MiG-21MF	968015	11-9-73	34 PLM	Noted Poznań 12-2003 withdrawn from use, reported 2004 in Holland and also Turin. See also Gor'kiy-built MiG-21MF c/n 96008015
8101	MiG-21MF	968101	11-9-73	34 PLM	Stored Dęblin, noted 5-1999
8702 Red	MiG-21MF	968702	9-2-74	26 PLM	Silver overall; had white band on rear fuselage/tail for war game. To 41 PLM, noted 3-1995, noted Poznań 10-2004 withdrawn from use
8703 Red	MiG-21MF	968703	9-2-74	26 PLM	Silver overall. Preserved San Carlos, Brazil, noted 2-2001
8704	MiG-21MF	968704	9-2-74	26 PLM	To 41 PLM, noted 3-1995, noted 8-2004 preserved Orneta
8705 (1)	MiG-21MF	968705	9-2-74	26 PLM	Stored Dęblin, noted 5-1999; see MiG-21bis table
8706	MiG-21MF	968706	9-2-74	26 PLM	To 41 PLM, noted 3-1995, 3 ELT 9-2003, noted preserved Turin or Netherlands 2004
8707	MiG-21MF	968707	9-2-74	26 PLM	10 PLM noted 4-1999
8907 Red	MiG-21MF	968907	26-3-74	26 PLM	Silver overall. Noted 9-2004 preserved Garczegorze without insignia
8908	MiG-21MF	968908	26-3-74	26 PLM	Crashed 14-11-1977
8909	MiG-21MF	968909	26-3-74	26 PLM	Preserved Baarlo, Holland
8910	MiG-21MF	968910	26-3-74	26 PLM	Noted stored Dęblin 5-1999
9010	MiG-21MF	969010	26-3-74	26 PLM	To 10 PLM, noted 3-1995, noted scrapped Babimost
9011 White outline	MiG-21MF	969011	26-3-74	26 PLM	Two-tone grey camouflage. To 10 PLM, noted 3-1995, preserved Tartu, Estonia
9012 White outline	MiG-21MF	969012	26-3-74	26 PLM	Two-tone grey camouflage. To 11 PLM, noted 6-1991, noted WFU Łask 6-2004
9013	MiG-21MF	969013	26-3-74	26 PLM	Crashed 12-8-1975
9014	MiG-21MF	969014	26-3-74	26 PLM	To 41 PLM, noted 5-1994
9015	MiG-21MF	969015	26-3-74	26 PLM	To 41 PLM, noted 5-1994, preserved Torun
9101	MiG-21MF	969101	18-4-74	26 PLM	To 41 PLM, noted 5-1994, noted stored Dęblin 5-1999
9102	MiG-21MF	969102	18-4-74	26 PLM	To 10 PLM noted 3-1995, noted stored Dęblin 5-1999
9103	MiG-21MF	969103	18-4-74	26 PLM	To 41 PLM noted 3-1995
9104	MiG-21MF	969104	16-4-74	34 PLM	Crashed 31-12-1975
9105 Red	MiG-21MF	969105	23-4-74	41 PLM	Silver overall. To 41 PLM, noted 3-1995, preserved Buk
9106	MiG-21MF	969106	16-4-74	34 PLM	To 41 PLM, noted 5-1994, preserved Malbork marked '41 PLM' noted 9-2003
9107 Red	MiG-21MF	969107	23-4-74	41 PLM	Silver overall. To 10 PLM, noted 1-2007, painted gold with *Smok Wawelski* dragon tail art. Preserved Kraków
9108	MiG-21MF	969108	16-4-74	34 PLM	To 11 PLM, noted 9-1994, 10 ELT seen 6-2000
9109	MiG-21MF	969109	23-4-74	41 PLM	Noted 5-1999 stored Dęblin, later at a school in Sacemin but not there mid-2007
9110 Red	MiG-21MF	969110	23-4-74	41 PLM	Noted 9-1994
9111 Red	MiG-21MF	969111	23-4-74	41 PLM	Noted 3-1995. Silver overall; repainted in NATO-style two-tone grey camouflage as 9111 Grey, eagle's head tail art. Seen 10-2004 preserved Poznań, noted 2007 preserved Poznań-Krzesiny
9112 Red	MiG-21MF	969112	7-5-74	41 PLM	Noted 3-1995, silver overall. Seen 10-2004 Poznań withdrawn from use
9113 Red	MiG-21MF	969113	7-5-74	41 PLM	Silver overall. Preserved Dęblin
9114 Red	MiG-21MF	969114	7-5-74	41 PLM	Grey overall. Noted 6-2004 Łask WFU
9115 Red	MiG-21MF	969115	7-5-74	41 PLM	Silver overall. Noted 9-1994
9201	MiG-21MF	969201	7-5-74	41 PLM	
9202	MiG-21MF	969202	7-5-74	41 PLM	Noted 9-2003 Babimost
9203	MiG-21MF	969203	7-5-74	41 PLM	Crashed 6-3-1984

The MiG-21MFs listed below were built at plant No. 21 in Gor'kiy and known locally as MiG-21MF-75s to indicate that their cockpit instrumentation was the same as on the MiG-21*bis*:					
7399	MiG-21MF	96007399	11-12-75	34 PLM	To 11 PLM, noted 8-1991; front fuselage preserved Leeuwarden, Holland
7405	MiG-21MF	96007405	11-12-75	34 PLM	To 11 PLM, crashed 1-3-1991
7436	MiG-21MF	96007436	11-12-75	34 PLM	To 11 PLM, noted 8-1991, seen preserved Nowa Sol 8-1998
7489	MiG-21MF	96007489	11-12-75	34 PLM	To 11 PLM, noted 9-1994
7502	MiG-21MF	96007502	11-12-75	34 PLM	To 11 PLM, noted 9-1994
7555	MiG-21MF	96007555	11-12-75	34 PLM	To 11 PLM, noted 8-1991; front fuselage noted Leeuwarden 1-2004
7600 Red	MiG-21MF	96007600	11-12-75	34 PLM	Silver overall. To 11 PLM, noted 8-1991; reported in Galveston, TX, USA, 12-2000
7656	MiG-21MF	96007656	11-12-75	34 PLM	Noted 4-1992 in Dęblin
7675	MiG-21MF	96007675	11-12-75	34 PLM	Stored Mierzęcice, noted 9-1994
7715	MiG-21MF	96007715	11-12-75	34 PLM	Withdrawn from service 24-1-1990
7760	MiG-21MF	96007760	11-12-75	34 PLM	To 11 PLM, noted 8-1995; seen 12-2000 Ridgeway, Ontario, Canada
7788	MiG-21MF	96007788	11-12-75	34 PLM	To 11 PLM, noted 9-1994, seen 12-1995 stored Mierzęcice
8015 Red (2)	MiG-21MF	96008015	11-12-75	34 PLM	Silver overall. See also Moscow-built MiG-21MF c/n 968015
8022	MiG-21MF	96008022	11-12-75	34 PLM	To 11 PLM noted 8-1991, Dęblin stored noted 8-1998
8039	MiG-21MF	96008039	11-12-75	34 PLM	To 11 PLM, noted 9-1994
8055	MiG-21MF	96008055	11-12-75	34 PLM	To 11 PLM, noted 9-1994
8099	MiG-21MF	96008099	11-12-75	34 PLM	To 11 PLM, noted 9-1994; reported in Galveston, Texas, USA, 12-2000
8113	MiG-21MF	96008113	11-12-75	34 PLM	Preserved Warsaw Army Muzeum
8122	MiG-21MF	96008122	11-12-75	34 PLM	Seen Dęblin 5-1999
8189 Red	MiG-21MF	96008189	11-12-75	34 PLM	Silver overall, *Smok Wawelski* dragon nose art. To 11 PLM by 8-1991; seen 1-2004 pres. Kruszyna/Częstochowa

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▲ **One more view of the Polish Navy MiG-21*bis* '8855 Red'.**

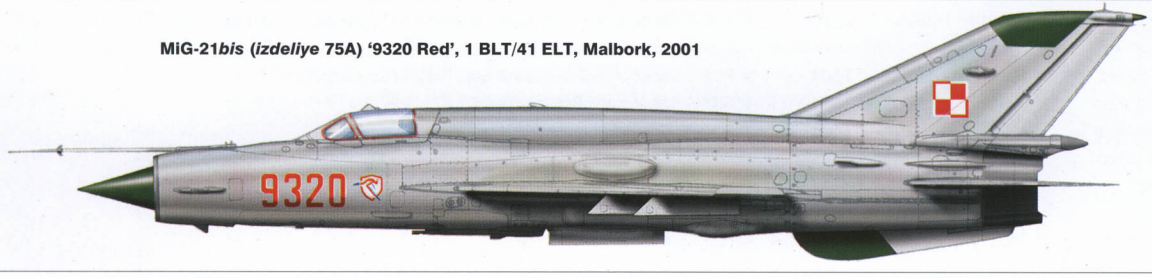
variant had a periscope on the top of the canopy and gun blast deflector plates below the auxiliary engine inlets.

Altogether the Polish Air Force received 120 MiG-21MFs, the first batch of eight arriving on 31st December 1972 for the 34 PLM at Gdynia-Babie Doly. A further sixteen were delivered there before 41 PLM at Malbork received its initial batch. While 34 PLM continued to be replenished, more new aircraft went to 28 PLM at Słupsk and 26 PLM at Zęgrze Pomorskie. During 1980-81 the 26 and 34 PLM re-equipped with new MiG-21*bis* machines and the surplus MiG-21MFs went to 2 PLM at Goleniów and 62 PLM at Poznań-Krzesiny. After 28 PLM received MiG-23MFs its MiG-21MFs were transferred to 9 PLM at Dębrzno, 10 PLM at Łask and 11 PLM at Wrocław. In 1988 the 9 PLM disbanded, passing on the designation to the former 26 PLM. 10 and 11 PLM continued to operate the MiG-21MF, with the latter unit having a detachment at Mierzęcice.

Surviving MiG-21MFs were withdrawn from service on 13th January 2003.

The last fighter variant, the MiG-21*bis* (*izdeliye* 75A), was produced solely at plant No. 21 in Gor'kiy from 1972 until 1985. By this time the construction numbers combined the initial digits 750 with the 'famous last five' of allegedly random numbers to hide the number of aircraft actually built. Deliveries of this fourth-generation

MiG-21*bis* (*izdeliye* 75A) '9320 Red', 1 BLT/41 ELT, Malbork, 2001



Waclav Holys

Waclav Holys

◄
MiG-21*bis* fighters of the 'new' 9 PLM (former 26 PLM) at Zęgrze Pomorskie, including '9204 Red' and '9507 Red' with the red/blue tail flash.

▲
The badge of the Polish Air Force and Air Defence Force (WLOP – Wojska Lotnicze i Obrona Powietrzna).

◄
Polish Navy/1 DLMW MiG-21s, such as MiG-21*bis* '0880 Red', had bird-scaring eyes to reduce the risk of colliding with seagulls. 'Navy' titles and a sharkmouth were added later.

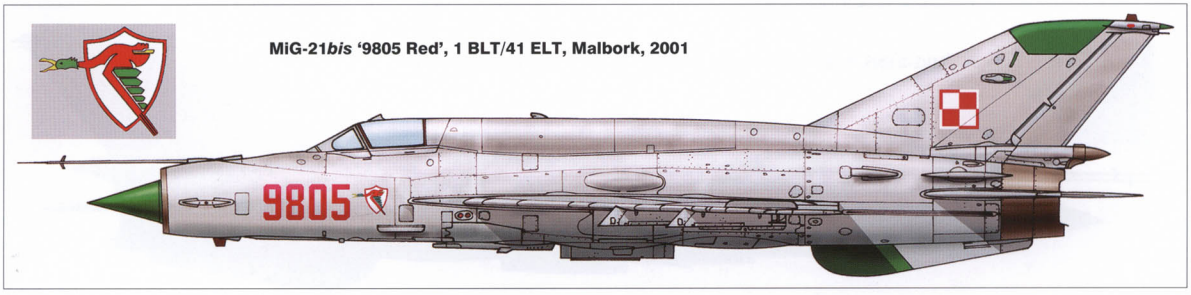
MiG-21 to Poland began on 6th March 1980 when nine were delivered for 34 PLM at Gdynia-Babie Doly and ultimately a total of thirty-six was received by the regiment. Another thirty-six went to 26 PLM at Zęgrze Pomorskie.

34 PLM was transferred to **Polish Naval Aviation** (*Lotnictwo Marynarki Wojennej*) in January 1991 and on 2nd January 1995 it became 1 DLMW (*Dywizjon Lotniczy Marynarki Wojennej*, Naval Aviation Squadron) with two

Polish Air Force MiG-21*bis* fighters

Serial	Version	C/n	Delivery date	First unit	Comments
0701	MiG-21*bis*	75080701	26-3-80	34 PLM	Crashed13-4-1989
0774	MiG-21*bis*	75080774	22-3-80	34 PLM	To 1 DLMW 2-1-1995, WFU 2002
0786	MiG-21*bis*	75080786	26-3-80	34 PLM	Crashed 26-1-1981
0798	MiG-21*bis*	75080798	22-3-80	34 PLM	To 1 DLMW 2-1-1995, WFU 2001
0800	MiG-21*bis*	75080800	22-3-80	34 PLM	To 1 DLMW 2-1-1995, WFU 2001
0804 Red	MiG-21*bis*	75080804	26-3-80	34 PLM	Silver overall; had white band on rear fuselage/tail for war game. To 1 DLMW 2-1-1995, noted WFU Poznań 10-2004
0809	MiG-21*bis*	75080809	22-3-80	34 PLM	To 1 DLMW 2-1-1995, WFU 2001
0845	MiG-21*bis*	75080845	26-3-80	34 PLM	To 9 ELT, noted 6-2000
0876	MiG-21*bis*	75080876	22-3-80	34 PLM	To 1 DLMW 2-1-1995, WFU 2002
0880 Red	MiG-21*bis*	75080880	22-3-80	34 PLM	Silver overall, bird-scaring eyes. To 1 DLMW 2-1-1995, tiger markings on tail, sharkmouth, NAVY titles
0887	MiG-21*bis*	75080887	22-3-80	34 PLM	To 1 DLMW 2-1-1995, crashed 29-10-1999
1007	MiG-21*bis*	75081007	22-3-80	34 PLM	To 1 DLMW 2-1-1995, WFU 2002
1029 Red	MiG-21*bis*	75081029	26-3-80	34 PLM	Silver overall. To 1 DLMW 2-1-1995, WFU 2002
8604 Red	MiG-21*bis*	75078604	6-3-80	34 PLM	Silver overall. To 1 DLMW 2-1-1995, noted WFU Poznań 10-2004
8645 Red	MiG-21*bis*	75078645	6-3-80	34 PLM	Silver overall. To LMW 1-1991, crashed 5-8-1992
8649 Red	MiG-21*bis*	75078649	6-3-80	34 PLM	Silver overall. To 1 DLMW 2-1-1995
8705 Red (2)	MiG-21*bis*	75078705	13-3-80	34 PLM	Silver overall, bird-scaring eyes. To 1 DLMW 2-1-1995, noted WFU Poznań 10-2004; noted 7-2007 stored Buk. See MiG-21MF
8745	MiG-21*bis*	75078745	6-3-80	34 PLM	To 1 DLMW 2-1-1995, noted with 41 ELT 4-2001
8801 Red	MiG-21*bis*	75078801	13-3-80	34 PLM	Silver overall. To 1 DLMW 2-1-1995, noted WFU Poznań 10-2004
8819 Red	MiG-21*bis*	75078819	13-3-80	34 PLM	Silver overall. To 1 DLMW 2-1-1995, noted WFU 1-2003
8822	MiG-21*bis*	75078822	13-3-80	34 PLM	To 1 DLMW 2-1-1995, noted 4-1999

8855 Red	MiG-21*bis*	75078855	13-3-80	34 PLM	Silver overall. To LMW 1-1991, withdrawn from use 17-5-1993, noted as GIA coded '07 Red' at CSSTWL Oleśnica 9-2002, noted 2007 as preserved in Tumlin
8859 Red	MiG-21*bis*	75078859	13-3-80	34 PLM	Silver overall, bird-scaring eyes. To 1 DLMW 2-1-1995, noted stored 5-2004 Gdynia-Babie Doly
8861 Red	MiG-21*bis*	75078861	6-3-80	34 PLM	Silver overall; had white band on rear fuselage/tail for war game. To 1 DLMW 2-1-1995, later to 41 PLM, written off 7-5-1999
8865 Red	MiG-21*bis*	75078865	6-3-80	34 PLM	Silver overall. To 1 DLMW 2-1-1995, WFU 2001
8870 Red	MiG-21*bis*	75078870	6-3-80	34 PLM	Silver overall, bird-scaring eyes. To 1 DLMW 2-1-1995, written off 28-6-1996
8880 Red	MiG-21*bis*	75078880	6-3-80	34 PLM	Silver overall; had white band on rear fuselage/tail for war game. To 1 DLMW 2-1-1995, WFU 2001
8890	MiG-21*bis*	75078890	13-3-80	34 PLM	To 1 DLMW 2-1-1995, written off 27-7-1996
8905 Red	MiG-21*bis*	75078905	6-3-80	34 PLM	To LMW 1-1991 written off 13-10-1994, preserved Gdynia Naval Museum with red nose and White eagle nose art instead of serial
8910	MiG-21*bis*	75078910	13-3-80	34 PLM	To 1 DLMW 2-1-1995, WFU 2002
8918	MiG-21*bis*	75078918	13-3-80	34 PLM	To LMW 1-1991, crashed 25-2-1994
8945 Red	MiG-21*bis*	75088945	26-3-80	34 PLM	Silver overall; had white band on rear fuselage/tail for war game. To 1 DLMW 2-1-1995, WFU 2001
8971 Red	MiG-21*bis*	75088971	26-3-80	34 PLM	Silver overall. To 1 DLMW 2-1-1995, WFU 1-2003, stored Malbork
8980 Red	MiG-21*bis*	75088980	26-3-80	34 PLM	Silver overall, bird-scaring eyes, white band on fuselage/tail for war game. To 1 DLMW 2-1-1995, WFU 2002
9027	MiG-21*bis*	75089027	26-3-80	34 PLM	Crashed 17-6-1982
9095	MiG-21*bis*	75089095	26-3-80	34 PLM	Crashed 16-6-1988
9145 Red	MiG-21*bis*	75089145	17-7-81	26 PLM	Silver overall. To 9 PLM 1989, noted 6-2000 3 ELT
9204 Red	MiG-21*bis*	75089204	17-7-81	26 PLM	Silver overall. To 9 PLM 1989, preserved MLiA, Kraków
9211 Red	MiG-21*bis*	75089211	17-7-81	26 PLM	Grey overall. To 9 PLM 1989, sold to Uganda
9307	MiG-21*bis*	75089307	17-7-81	26 PLM	To 9 PLM 1989, sold to Uganda
9314 Red	MiG-21*bis*	75089314	17-7-81	26 PLM	Grey nose up to wing leading edge, rest of airframe silver. To 9 PLM 1989, noted 10-2004 WFU Poznań
9320 Red	MiG-21*bis*	75089320	17-7-81	26 PLM	Silver overall. To 9 PLM 1989, noted 41 ELT 4-2001
9334 Red	MiG-21*bis*	75089334	17-7-81	26 PLM	Silver overall. To 9 PLM 1989, noted 41 ELT 4-2001
9345 Red	MiG-21*bis*	75089345	17-7-81	26 PLM	Grey overall. To 9 PLM 1989
9381 Red	MiG-21*bis*	75089381	17-7-81	26 PLM	Silver overall. To 9 PLM 1989, noted 9 ELT 6-2000
9407	MiG-21*bis*	75089407	17-7-81	26 PLM	To 9 PLM 1989, noted 41 ELT 4-2001
9424 Red	MiG-21*bis*	75089424	17-7-81	26 PLM	Silver overall, national insignia also carried on fuselage. To 9 PLM 1989
9444 Red	MiG-21*bis*	75089444	17-7-81	26 PLM	Grey overall. To 9 PLM 1989, noted 41 ELT 4-2001
9483 Red	MiG-21*bis*	75089483	17-7-81	26 PLM	Silver overall. To 9 PLM 1989, noted 9 ELT 9-2002 as 9483 Black
9494 Red	MiG-21*bis*	75089494	17-7-81	26 PLM	Grey overall. To 9 PLM 1989, noted Dęblin 4-1992; written off 17-7-2000
9501 Red	MiG-21*bis*	75089501	17-7-81	26 PLM	Silver overall. To 9 PLM 1989, noted Poznań 10-2004 withdrawn from use
9507 Red	MiG-21*bis*	75089507	17-7-81	26 PLM	Silver overall, red/blue flash on rudder. To 9 PLM 1989, noted Poznań 10-2004 withdrawn from use
9524 Red	MiG-21*bis*	75089524	17-7-81	26 PLM	Grey overall. To 9 PLM 1989, noted Poznań 5-2004 withdrawn from use
9545 Red	MiG-21*bis*	75089545	17-7-81	26 PLM	Silver overall. To 9 PLM 1989, noted 41 PLM 11-1999
9564	MiG-21*bis*	75089564	9-9-81	26 PLM	To 9 PLM 1989
9700 Red	MiG-21*bis*	75089700	9-9-81	26 PLM	Silver overall; had white band on rear fuselage/tail for war game. To 9 PLM 1989, noted 41 ELT 4-2001
9703 Red	MiG-21*bis*	75089703	9-9-81	26 PLM	Silver overall. To 9 PLM 1989, noted Poznań 10-2004 withdrawn from use
9708	MiG-21*bis*	75089708	4-12-81	26 PLM	To 9 PLM 1989
9735 Red	MiG-21*bis*	75089735	9-9-81	26 PLM	Silver overall. To 9 PLM 1989, noted 41 ELT 6-2000
9745 Red	MiG-21*bis*	75089745	9-9-81	26 PLM	Grey overall. To 9 PLM 1989, noted Poznań 10-2004 withdrawn from use
9749	MiG-21*bis*	75089749	9-9-81	26 PLM	To 9 PLM 1989, crashed 29-9-2001
9763 Red	MiG-21*bis*	75089763	9-9-81	26 PLM	Silver overall; had white band on rear fuselage/tail for war game. To 9 PLM 1989, noted Poznań 10-2004 withdrawn from use
9784 Red	MiG-21*bis*	75089784	9-9-81	26 PLM	Silver overall; had white band on rear fuselage/tail for war game, later grey overall. To 9 PLM 1989, noted Poznań 10-2004 withdrawn from use
9799	MiG-21*bis*	75089799	9-9-81	26 PLM	To 9 PLM 1989, sold to Uganda 8-1999
9801 Red	MiG-21*bis*	75089801	9-9-81	26 PLM	Silver overall. To 9 PLM 1989, sold to Uganda 8-1999
9805 Red	MiG-21*bis*	75089805	9-9-81	26 PLM	To 9 PLM 1989, noted 41 ELT 4-2001
9809	MiG-21*bis*	75089809	9-9-81	26 PLM	To 9 PLM 1989
9811 Red	MiG-21*bis*	75089811	9-9-81	26 PLM	Silver overall. To 9 PLM 1989, sold to Uganda 8-1999
9818 Red	MiG-21*bis*	75089818	9-9-81	26 PLM	Silver overall; had white band on rear fuselage/tail for war game. To 9 PLM 1989, sold to Uganda 8-1999
9843	MiG-21*bis*	75089843	9-9-81	26 PLM	To 9 PLM 1989
9854 Red	MiG-21*bis*	75089854	9-9-81	26 PLM	Silver overall. To 9 PLM 1989, noted WFU Poznań 10-2004
9975 Red	MiG-21*bis*	75089975	9-9-81	26 PLM	Silver overall, national insignia also carried on fuselage. To 9 PLM 1989, noted with 41 PLM 5-1999



MiG-21*bis* '9805 Red', 1 BLT/41 ELT, Malbork, 2001

Waclav Holys

◀ **MiG-21*bis* '9483' operated by 9 ELT has a non-standard black serial. The fighter is carrying an R-3U fixed acquisition round.**

Eskadra (A and B), each with 18 MiG-21*bis*, in the strike role.

Six were sold to the Ugandan Air Force in 1999 when some naval aircraft were transferred back to the Air Force.

The type was finally withdrawn from use by the Navy on 31st January 2003 and by the Air force on 31st December 2003.

Although, as noted earlier, the MiG-21F-13 was delivered between 1961 and 1963, it was not until 1965 that six MiG-21U (*izdeliye* 66-400) two-seat trainers arrived for the Polish Air Force. This version was developed from the MiG-21F-13 and built at MMZ No. 30 'Znamya Truda' with the parabrake located below the fuselage.

Two went to 40 PLM, two to 1 PLM and one each to 41 PLM and CSL Modlin. The single aircraft from CSL Modlin was transferred to 39 PLM where it was joined by another from 41 PLM but sadly, both these trainers plus one from 1 PLM were lost in accidents. Ultimately the three survivors were transferred to 1 PLM from which unit all three were withdrawn from service in February 1990.

A later development, the MiG-21U (*izdeliye* 66-600) also built at MMZ No. 30, featured a broader tailfin with the parabrake relocated immediately below the rudder. Five were delivered in July and August 1966: three to 40 PLM and two to 41 PLM.

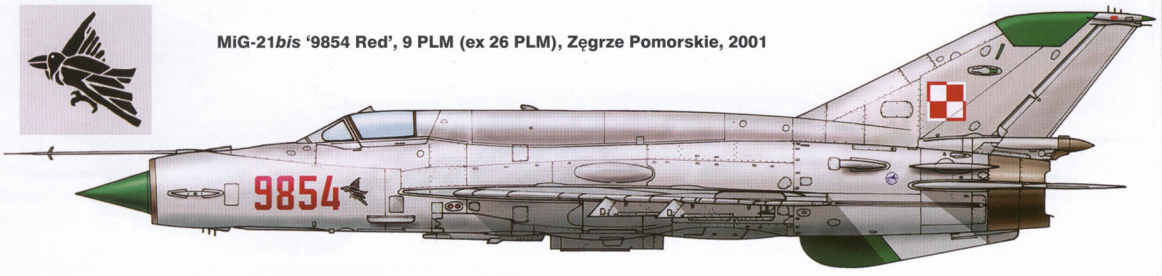
All survived until withdrawn from service between December 1989 and February 1990, by which time all five were with 1 PLM.

Waclav Holys

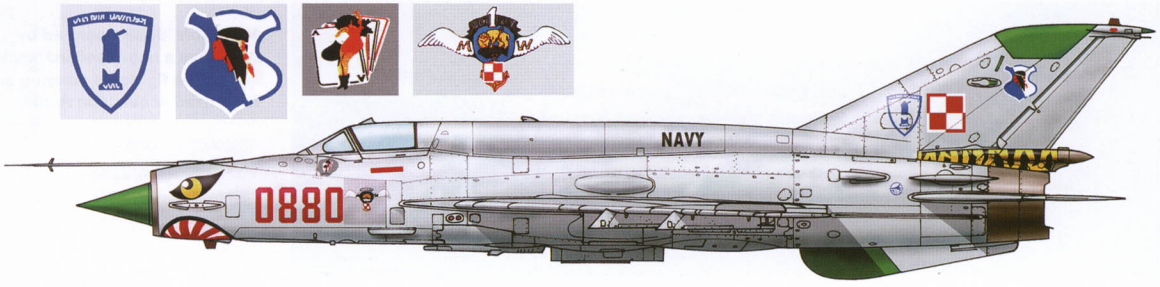
Waclav Holys

▲ **MiG-21US '4503 Red' operated by CSL Modlin carried the national insignia on the rear fuselage in addition to the fin, a rare occurrence for the type.**

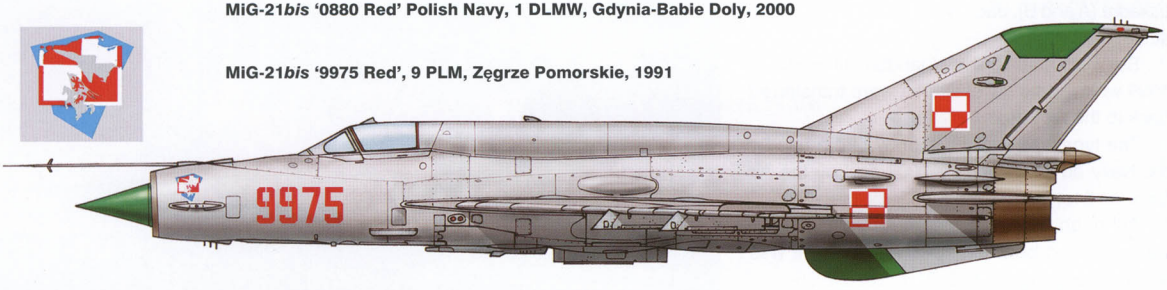
Based and instrumented on the MiG-21PFM (*izdeliye* 94), the next trainer version was the MiG-21US (*izdeliye* 68A). This variant featured blown flaps and forward-looking periscope on the canopy to improve the instructor's field of view from the rear seat. All were built at *zavod* 31 *imeni Dimitrova* in Tbilisi, Georgia.



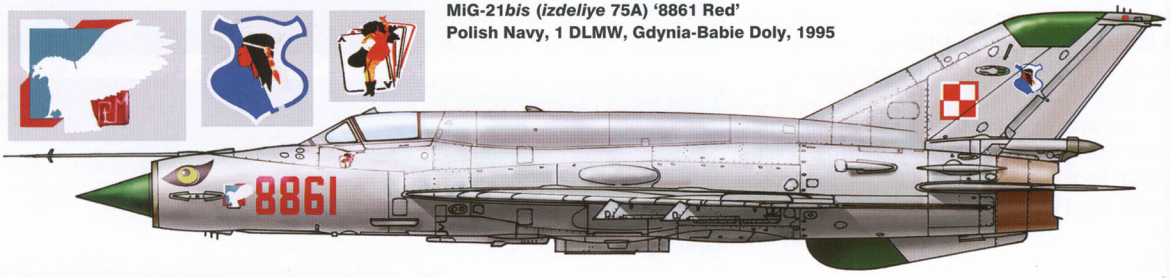
MiG-21*bis* '9854 Red', 9 PLM (ex 26 PLM), Zęgrze Pomorskie, 2001



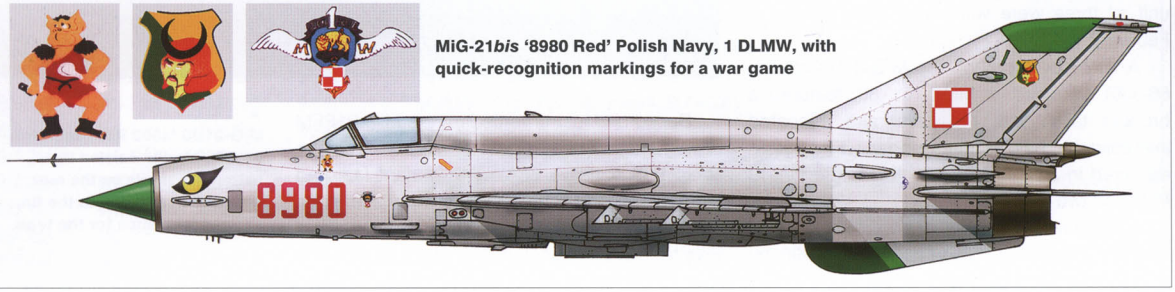
MiG-21*bis* '0880 Red' Polish Navy, 1 DLMW, Gdynia-Babie Doly, 2000



MiG-21*bis* '9975 Red', 9 PLM, Zęgrze Pomorskie, 1991

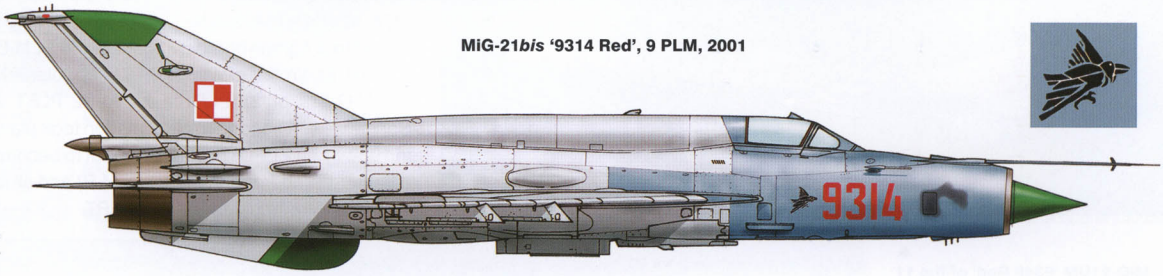


MiG-21*bis* (*izdeliye* 75A) '8861 Red'
Polish Navy, 1 DLMW, Gdynia-Babie Doly, 1995

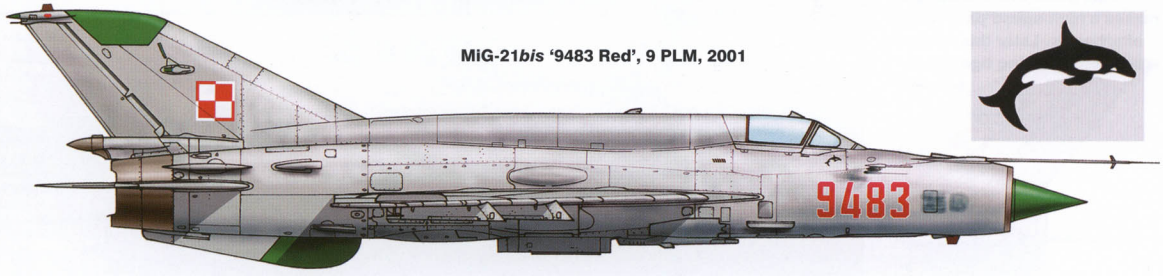


MiG-21*bis* '8980 Red' Polish Navy, 1 DLMW, with quick-recognition markings for a war game

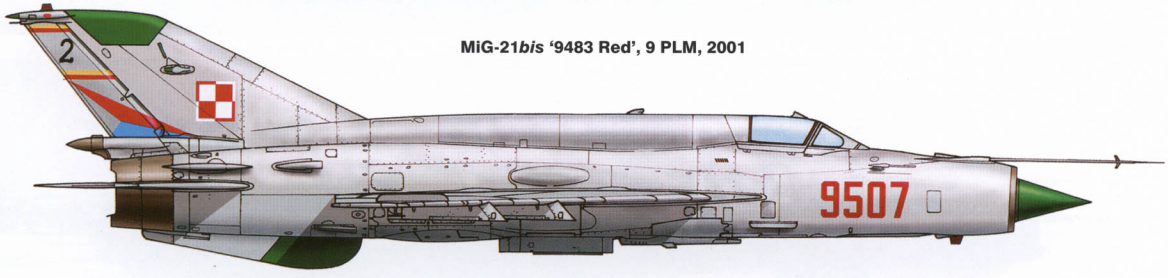
MiG-21*bis* '9314 Red', 9 PLM, 2001



MiG-21*bis* '9483 Red', 9 PLM, 2001

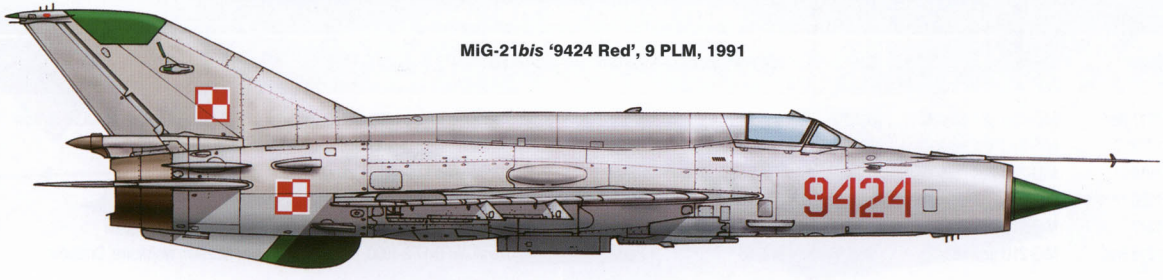


MiG-21*bis* '9483 Red', 9 PLM, 2001



MiG-21*bis* '8905 Red', Polish Navy Museum, Gdynia, 2001

MiG-21*bis* '9424 Red', 9 PLM, 1991



Wacław Hołys

PLRT at Powidź, 39 PLM at Mierzęcice and 62 PLM at Poznań-Krzesiny. When 40 PLM converted to a fighter-bomber regiment (40 PLM-B) in 1970, its aircraft moved to 2 PLM at Goleniów; the MiG-21s of 21 PLRT went to 32 PLRT at Sochaczew. A second transformation took place in 1982 when 21 PLRT was also about to become a fighter-bomber regiment (21 PLM-B) and all its MiG-21s were transferred to 32 PLRT.

▲ **MiG-21UM '9349 Red' of the 11 PLM fitted with a drop tank makes a high-speed pass in full afterburner. Later this aircraft received a striking tiger colour scheme.**

Wacław Hołys

▶ **Sister ship '7507 Red' was operated by the 62 PLM/2 Sqn, as indicated by the unit badge.**

via RART

▶ **MiG-21UM '9311 While outline' belonging to 10 PLM shows the latest standard grey camouflage and low-visibility serial.**

Twelve were delivered between August 1969 and August 1970; nine went at first to the CSL in Modlin, two to 34 PLM and one to 26 PLM. The CSL's MiG-21USs were later distributed to 1 PLM at Mińsk-Mazowiecki, 11 PLM at Wrocław, 21

The MiG-21US survivors were withdrawn from service on 31st December 2003.

The MiG-21UM (izd. 69) was the final trainer version, instrumented and equipped to train pilots for third- and fourth-generation MiG-21s.

Polish Air Force MiG-21U trainers

Serial	Version	C/n	Delivery date	First unit	Comments
1217 Red	MiG-21U (*izd.* 66-400)	661217	19-5-65	40 PLM	Silver overall. To 1 PLM 1970, withdrawn from use 17-2-1990, preserved MLiA, Kraków
1218	MiG-21U (*izd.* 66-400)	661218	19-5-65	40 PLM	To 1 PLM 1970, WFU 17-2-1990
1219	MiG-21U (*izd.* 66-400)	661219	19-5-65	41 PLM	To 39 PLM, crashed 11-5-1971 after collision with MiG-21PF 0905
1220	MiG-21U (*izd.* 66-400)	661220	18-5-65	CSL Modlin	To 39 PLM, crashed 14-6-1978
1317	MiG-21U (*izd.* 66-400)	661317	4-6-65	1 PLM	Crashed 16-1-1978
1318 Red	MiG-21U (*izd.* 66-400)	661318	4-6-65	1 PLM	Silver overall. WFU 17-2-1990, preserved *Lubuskie Muzeum Wojskowe*, Drzonów

Polish Air Force MiG-21U trainers (continued)					
Serial	**Version**	**C/n**	**Delivery date**	**First unit**	**Comments**
2718	MiG-21U (*izd.* 66-600)	662718	8-7-66	40 PLM	Silver overall. To 1 PLM 1970, withdrawn from service 17-2-1990, preserved Musée du Château de Savigny (Savigny-lès-Beaune, France) without insignia
2719	MiG-21U (*izd.* 66-600)	662719	5-8-66	41 PLM	Silver overall, unit badge on nose. To 1 PLM, withdrawn from service 11-22-1989, preserved Polish Eagles Foundation, Góraszka, as '2420 Red' without insignia
2720 Red	MiG-21U (*izd.* 66-600)	662720	5-8-66	41 PLM	Silver overall. To 1 PLM, withdrawn from service 11-12-1989, preserved Łódź, all insignia scrubbed out
3317	MiG-21U (*izd.* 66-600)	663317	13-8-66	40 PLM	To 1 PLM 1970, withdrawn from service 17-2-1990
3318	MiG-21U (*izd.* 66-600)	663318	13-8-66	40 PLM	1 PLM 1970, withdrawn from service 11-12-1989

MiG-21U (izdeliye 66-400) '1318 Red', 1 PLM 'Warszawa' Mińsk-Mazowiecki, 1990; note the extra national insignia on the fuselage
1318
MiG-21UM '6510 Red', 34 PLM, Malbork
6510
9313
MiG-21UM '9313 Red' Agata, Polish Navy, 1996
62
2
Agata
MiG-21UM '5710 Red', 62 PLM/2 Sqn, Poznań-Krzesiny
5710

Polish Air Force MiG-21USs

Serial	Version	C/n	Delivery date	First unit	Comments
4007 Red	MiG-21US	07685740	24-9-69	34 PLM	Silver overall. To 1 PLM. Noted stored Mierzęcice 2-1995 and at Gatlinburg, USA, 10-2002
4010 Red (2)	MiG-21US	10685140	24-9-69	34 PLM	Silver overall. Noted 8-1991 dumped Poznań-Krzesiny; see MiG-21PFM
4401 Red	MiG-21US	01685144	20-3-70	CSL Modlin	Silver overall. WFU 21-1-1990, preserved MLiA, Kraków
4402	MiG-21US	02685144	20-3-70	CSL Modlin	To 1 PLM, sold to USA 3-1996 as N6258U became N22FR c.1999
4502	MiG-21US	02685145	20-4-70	CSL Modlin	Noted stored Mierzęcice 9-1994, sold to USA as N221MG
4503 Red	MiG-21US	03685145	20-4-70	CSL Modlin	Silver overall, nat'l insignia also carried on fuselage. Noted as GIA at CSSTWL Oleśnica 4-1994
4504	MiG-21US	04685145	20-4-70	CSL Modlin	Sold to Texas, USA, 1993 as N1121M
4608	MiG-21US	08685146	10-6-70	CSL Modlin	Noted stored Mierzęcice 2-1995, sold to USA 10-1995 as N9149F
4609	MiG-21US	09685146	10-6-70	CSL Modlin	Crashed 20-9-1977
4610	MiG-21US	10685146	25-6-70	26 PLM	Withdrawn from use 17-2-1990
4701	MiG-21US	01685147	7-8-70	CSL Modlin	Noted stored Mierzęcice 5-1993
5141	MiG-21US	01685141	28-8-69	CSL Modlin	Withdrawn from use 29-5-1991, stored Mierzęcice and sold to Wanaka Transport & Toy Museum, New Zealand 6-2000

Polish Air Force MiG-21UMs

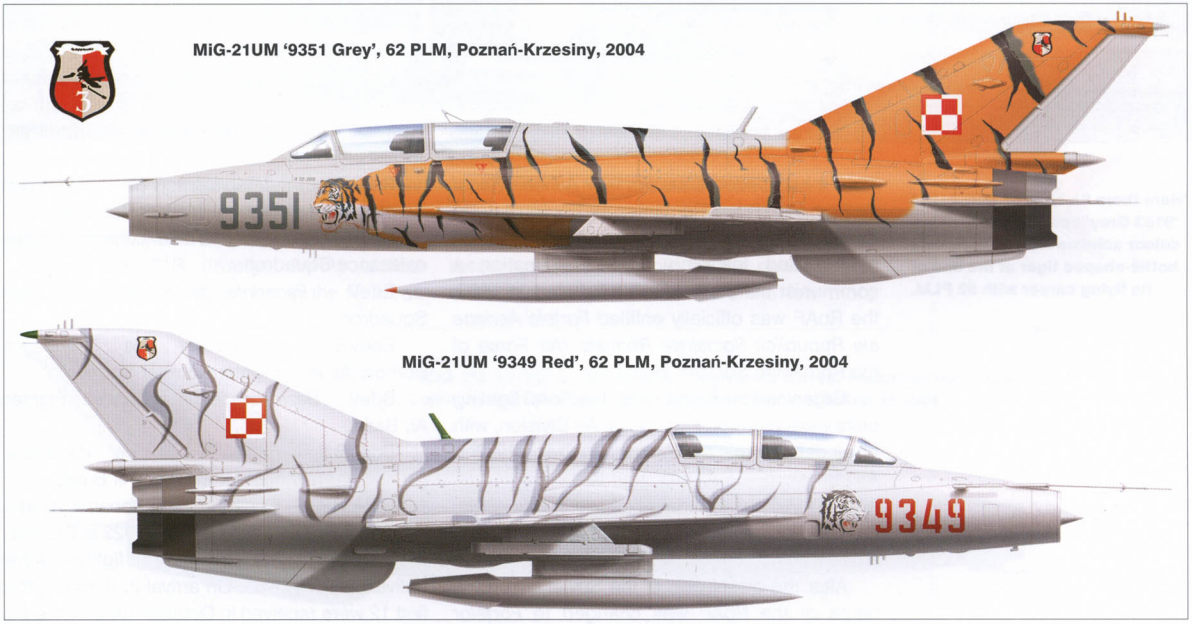
Serial	Version	C/n	Delivery date	First unit	Comments
0856 Red	MiG-21UM	08695156	26-7-71	41 PLM	Silver overall; had white band on rear fuselage/tail for war game. Later 32 PLRT, preserved Sion (Switzerland)
5709	MiG-21UM	09695157	15-9-71	41 PLM	Later 32 PLRT, preserved Buk
5710 Red	MiG-21UM	10695157	15-9-71	41 PLM	Silver overall. To 62 PLM/2 Sqn, preserved Buk
6006	MiG-21UM	06695160	22-1-72	41 PLM	Preserved Warsaw Technical Museum
6507 Red	MiG-21UM	07695165	26-6-72	32 PLRT	Silver overall. Later 62 PLM, sold to USA as N321ST
6508	MiG-21UM	08695165	26-6-72	32 PLRT	Crashed 11-5-1985
6509 Red (3)	MiG-21UM	09695165	22-6-72	34 PLM	Silver overall; serial later amended to 6509U Red. Preserved Aeolus Park, Holland
6510 Red	MiG-21UM	10695165	22-6-72	34 PLM	Silver overall, *Smok Wawelski* dragon nose art. Later 62 PLM, preserved Łódź
7502	MiG-21UM	02695175	7-7-73	9 PLM	Noted as instructional airframe 12-2004, preserved *Kolekcja Lotniczych Zakładów Naukowych*, Wrocław
7503 Red	MiG-21UM	03695175	7-7-73	9 PLM	Silver overall. Later 10 PLM
7505 Red	MiG-21UM	05695175	22-6-73	34 PLM	Silver overall, *Smok Wawelski* dragon nose art. Sold to USA as N711MG, serial applied as 7505U Red
7506	MiG-21UM	06695175	22-6-73	34 PLM	
7507 Red	MiG-21UM	07695175	22-6-73	34 PLM	Later 62 PLM/2 Sqn and 10 PLM, preserved Buk
At this point the type of construction number was changed to a more secure one ending in five supposedly random digits:					
3046	MiG-21UM	516903046	21-11-73	32 PLRT	Later 32 PLRT, noted 8-2003 stored Babimost
3056	MiG-21UM	516913056	11-5-74	28 PLM	Sold to USA as N317DM 3-1992
3061	MiG-21UM	516913061	11-5-74	34 PLM	Crashed 1-10-1980
5006	MiG-21UM	516905006		41 PLM	Later 32 PLRT, noted 2-2002 for sale Dęblin
5011	MiG-21UM	516905011	11-11-73	34 PLM	Sold to Australia 21-12-1992 as VH-XXI/'Indian Air Force U2146'
5016	MiG-21UM	516905016	6-11-73	26 PLM	To 32 PLRT, preserved Buk
5021 Red	MiG-21UM	516905021	6-11-73	26 PLM	Silver overall. Preserved Orbe, Switzerland
9229 Red	MiG-21UM	516999229	18-1-80	34 PLM	Silver overall. To LMW 1-1991, to 1 DLMW 2-1-1995, noted stored Babie Doly 5-2004
9231	MiG-21UM	516999231	18-1-80	34 PLM	To LMW 1-1991, to 1 DLMW 2-1-1995, noted stored Gdynia-Babie Doly 5-2004
9232	MiG-21UM	516999232	18-1-80	34 PLM	To LMW 1-1991, to 1 DLMW 2-1-1995, noted withdrawn from use 2002
9233 Red	MiG-21UM	516999233	18-1-80	34 PLM	at one time To LMW 1-1991, to 1 DLMW 2-1-1995, noted 6-2004 WFU Łask
9292 Grey	MiG-21UM	516999292	5-9-80	9 PLM	Preserved Buk; overall tiger colour scheme on grey background
9293 Red	MiG-21UM	516999293	21-5-80	9 PLM	Silver overall. To 2 PLM, sold to USA 9-2002 as N221UM
9294	MiG-21UM	516999294	21-5-80	9 PLM	To LMW 1-1991
9296	MiG-21UM	516999296	21-5-80	9 PLM	Preserved Olchowa
9297	MiG-21UM	516999297	8-5-80	41 PLM	Noted 4-2001 41 ELT

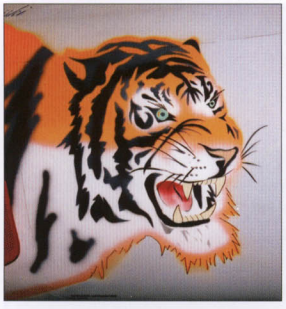
9298	MiG-21UM	516999298	8-5-80	41 PLM	Noted 4-2001 41 ELT
9306	MiG-21UM	516999306	28-7-80	26 PLM	To 9 PLM, sold to Uganda 2002
9307	MiG-21UM	516999307	28-7-80	26 PLM	9 PLM
9308 Grey	MiG-21UM	516999308	28-7-80	26 PLM	Overall tiger colour scheme on grey background
9309	MiG-21UM	516999309	28-7-80	26 PLM	To 9 PLM
9311	MiG-21UM	516999311	28-7-80	26 PLM	Noted withdrawn from use 9-1994, stored Mierzęcice, to 10 PLM; 10-2004 noted
White outline					Poznań-Krzesiny in two-tone grey camouflage, silver nose; noted 7-2007 stored Buk
9312	MiG-21UM	516999312	28-7-80	26 PLM	Noted 4-2001 9 ELT
9313 Red	MiG-21UM	516999313	16-8-80	34 PLM	To LMW 1-1991, written off 21-1-1997, noted Gdynia-Babie Doly 5-1999
9314	MiG-21UM	516999314	16-8-80	34 PLM	Crashed 5-6-1981
9316	MiG-21UM	516999316	13-8-80	41 PLM	
9317 Red	MiG-21UM	516999317	13-8-80	41 PLM	Silver overall
9321	MiG-21UM	516999321	5-9-80	9 PLM	Noted 6-2004 withdrawn from use Łask
9322	MiG-21UM	516999322	5-9-80	9 PLM	
9323 Red	MiG-21UM	516999323	26-9-80	41 PLM	Silver overall. Noted 41 ELT 4-2001
9324	MiG-21UM	516999324	26-9-80	41 PLM	Noted 9 ELT 6-2000
9343	MiG-21UM	516999343	5-5-81	11 PLM	Sold to USA as N57GS by 5-2001
9344	MiG-21UM	516999344			Noted 3 ELT 9-2002
9346	MiG-21UM	516999346	5-5-81	11 PLM	To 1 DLMW, noted WFU 2001
9347	MiG-21UM	516999347	5-5-81	11 PLM	Later 9 PLM, then 41 ELT
9348	MiG-21UM	516999348	5-5-81	11 PLM	Later 34 PLM, noted withdrawn from service Poznań 10-2004
9349 Red	MiG-21UM	516999349	5-5-81	11 PLM	Silver overall. Later 62 PLM, white overall with tiger's head & grey tiger stripes. Preserved MLiA, Kraków
9351 Grey	MiG-21UM	516999351	5-5-81	11 PLM	Later 62 PLM, overall tiger colour scheme on grey background; noted withdrawn from service
					Poznań-Krzesiny 10-2004
9352 Red	MiG-21UM	516999352	5-5-81	11 PLM	Silver overall. Noted withdrawn from service Poznań-Krzesiny 10-2004
9353	MiG-21UM	516999353	5-5-81	11 PLM	Noted withdrawn from service Łask 9-2004
9354	MiG-21UM	516999354	5-5-81	11 PLM	Preserved Buk

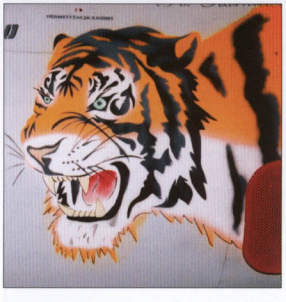
Between 1971 and 1981 the Polish Air Force received fifty-four of this variant, which served with all regiments flying MiG-21s during that period. This type was only built at plant No. 31 in Tbilisi.

Note the change of the construction number system in late 1973 deliveries to include the 'famous last five' so-called random digits.

The survivors were finally withdrawn from service on 31st December 2003.







via Intenet

Romania

The **Romanian Air Force** (RoAF, or *Forțele Aeriene Române*) originated in 1910 when the Romanian Army formed the modest *Corpul Aerian Român* (Flying Corps). Although wiped out in the First World War, the Army established a new force, *Divisia I-a Aeriana*, in 1918. By the time Romania joined the Axis on 23rd November 1940 it had become the *Forțelor Aeriene Regal de România* (Royal Romanian Air Force). A coup on 23rd August 1944 overthrew the fascist regime and following Soviet occupation a communist state was declared. Later, in 1965, the RoAF was officially entitled *Forțele Aeriene ale Republicii Socialiste Române* (Air Force of the Romanian Socialist Republic).

Organised on Soviet lines, the RoAF fighting units were grouped into the 1st Air Division, with an air defence role similar to the PVO and the 2nd Air Division supporting the Army as frontal aviation. Within the divisions were regiments, each of which usually contained three *escadrila* (squadrons).

After the dissolution of the Soviet Union the name of the RoAF was changed to *Forțelor Aeriene României* and on 1st June 1995 the regiments were replaced by Air Bases (*Baza Aeriana*) at which were located Groups (*Grupul*) carrying the same designated number. Each group usually had two squadrons.

Abbreviations used in the tables:

RdeV – *Regiment de Vânătoare*, Fighter Regiment;

RdeVB – *Regiment de Vânătoare Bombardament*, Fighter-Bomber Regiment;

EdeR – *Escadrila de Recunoastere*, Reconnaissance Squadron;

EdeV – *Escadrila de Vânătoare*, Fighter Squadron;

EdeVB – *Escadrila de Vânătoare Bombardament*, Fighter-Bomber Squadron;

BdeV – *Baza Aviație de Vânătoare*, Fighter Air Base;

BdeVB – *Baza Aviație de Vânătoare Bombardament*, Fighter-Bomber Air Base;

CMA 322 – *Centrul de Mentenanța Aviație* 322, Aircraft Maintenance Centre 322 at Craiova.

24 MiG-21F-13 (*izdeliye* 74) fighters were delivered in 1962-63. On arrival in Romania the first 12 were received in October 1962 by the 1st

Wacław Holys

▲ **'Here there be tygers.' MiG-21UM '9153 Grey' sported this striking colour scheme with a hilariously bottle-shaped tiger at the end of its flying career with 62 PLM.**

squadron of the 93th Fighter Regiment at Deveselu, moving in the summer of 1963 to Giarmata AB near Timişoara on completion of its runway extension. The second delivery in August 1963 was for 57th Fighter Regiment at Mihail Kogălniceanu AB near Constanța. The survivors were withdrawn from active service in 1976 but not written off until 1993; many were used as ground instructional airframes.

Delivery of MiG-21PF (*izdeliye* 76) began in 1965 and it is believed that a total 38 were received, although another was noted with an out-of-sequence number, 38x, which (if it ever existed) was likely to have been one of the aircraft listed below temporarily renumbered to confuse potential enemies. The RoAF gave the MiG-21PF the local designation **MiG-21RFM** (*radar fortaj modernizat*, radar/afterburner/modernised) and on arrival equipped 86 RdeV at Borcea-Feteşti and 91 RdeV at Deveselu. The survivors were finally withdrawn from service and grounded in the early 1990s and all put into storage by 1999.

First deliveries of the MiG-21PFM (*izdeliye* 94A) arrived in Romania in 1966, subsequently a total of 29 were in service before they were joined by 23 MiG-21PFM (*izdeliye* 94N), each of which was capable of carrying a tactical nuclear bomb. There were also reports of two aircraft bearing out-of-sequence two-digit serials with an 'X' postscript but it is reasonable to suppose it was a case of two of the examples listed below being temporarily renumbered.

As a result of the Conventional Forces in Europe (CFE) Treaty of 19th January 1990 the aircraft with nuclear capability had that facility removed. Both variants were known in the RoAF as the **MiG-21RFMM**. This version was not withdrawn from service until 2002 at which time they were serving with the second *Escadrila* of *Baza Aeriana* 86 Bombardament (86th Bomber Aviation Base, 86 BA) at Borcea-Feteşti; they were replaced by MiG-21 Lancer As.

Eleven MiG-21R (*izdeliye* 94RA) tactical reconnaissance aircraft, known in the RoAF as the **MiG-21C** (*cercetare*, reconnaissance), were delivered from 1968, continuing in service at Timişoara-Giarmata AB until 1998.

60 MiG-21M (*izdeliye* 96) fighters started arriving in Romania in 1969. They were a vast improvement on the MiG-21PFM, having a built-in cannon in addition to other refinements, including four wing hardpoints instead of two. Over 40 MiG-21Ms were delivered new to 57 BdeV.

The MiG-21Ms and MiG-21MFs were later selected as suitable variants for an upgrade. The Romanian government decided that, until resources were available for the new fighters, it would be expedient to retire the few more

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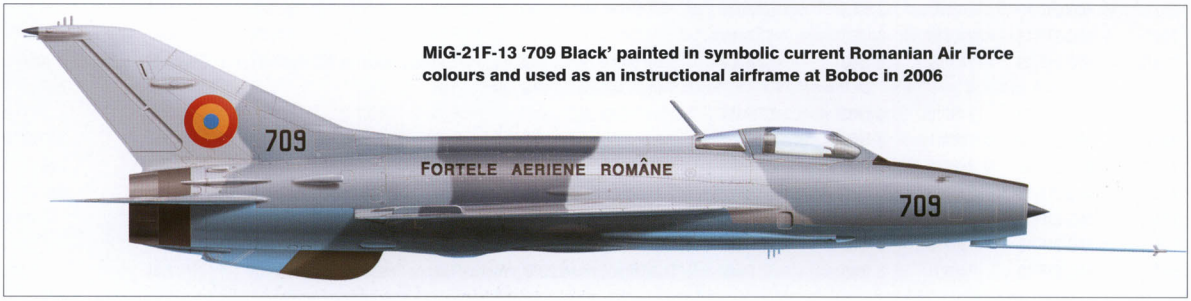
▲ **Romanian Air Force MiG-21F-13s with two-digit serials were Gor'kiy-built and delivered in 1962, while '709 Red' comes from the Moscow-built second batch.**



MiG-21F-13 '709 Black' painted in symbolic current Romanian Air Force colours and used as an instructional airframe at Boboc in 2006

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advanced but more expensive machines such as the MiG-23MFs and MiG-29s and to upgrade suitable MiG-21s, of which there was an abundance.

MiG-21Ms received the Lancer A fighter-bomber upgrade only and could be distinguished from Lancer C interceptors by the green, rather than black, radome and the light green/dark green/dark earth/tan camouflage rather than the Lancer C's three-tone grey camouflage (occasionally with *Forțele Aeriene Române* titles). The Lancer upgrade programme ultimately involved 99 single-seaters (73 Lancer As and 26 Lancer Cs) and 14 two-seat Lancer Bs.

The last fighter version purchased by the RoAF was the MiG-21MF (*izdeliye* 96F). It came in two varieties: the first, totalling 36 built at MMZ No. 30 'Znamya Truda' in Moscow, was the standard model which made its debut with the RoAF in 1972; the second (35 delivered) was built at *zavod* 21 *imeni Sergo Orzhonikidze* in Gor'kiy from 1975 onwards and was given the local designation MiG-21MF-75 as it incorporated the cockpit details of the new MiG-21*bis*; such aircraft are marked * in the table on page 657. Many of the aircraft listed below went to 93

Romanian Air Force MiG-21F-13s

Serial	Version	C/n	Delivered	First Unit	Comments
10 Red	MiG-21F-13	N74211710	10-1962	93 RdeV	Silver overall. Preserved Bucharest-Otopeni airport
11	MiG-21F-13	N74211711	10-1962	93 RdeV	
12 Red	MiG-21F-13	N74211712	10-1962	93 RdeV	Silver overall. Noted 2006 stored Deveselu
13	MiG-21F-13	?	10-1962	93 RdeV	
16	MiG-21F-13	N74212216	10-1962	93 RdeV	Preserved Craiova Base Museum, noted 2007 at the Electro-technical Faculty, Craiova, as instructional airframe
17	MiG-21F-13	?	10-1962	93 RdeV	
18	MiG-21F-13	?	10-1962	93 RdeV	Preserved Henri Coandă College, Baneasa Airport, Bucharest
20 Red	MiG-21F-13	?	10-1962	93 RdeV	Silver overall. Noted 2006 stored Deveselu in special white/light green/dark green colour scheme
21	MiG-21F-13	?	10-1962	93 RdeV	
22	MiG-21F-13	?	10-1962	93 RdeV	
23 Black	MiG-21F-13	?	10-1962	93 RdeV	Noted 2006 preserved Bacău in dark green/light green/tan camouflage
24	MiG-21F-13	?	10-1962	93 RdeV	
705 Red	MiG-21F-13	740705	8-1963	57 RdeV	Noted 2006 stored Deveselu
706	MiG-21F-13	740706	8-1963	57 RdeV	Noted 2006 preserved Boboc, Ianca, Training College as 'Popic' instructional airframe
707	MiG-21F-13	740707	8-1963	57 RdeV	
708	MiG-21F-13	740708	8-1963	57 RdeV	
709 Red	MiG-21F-13	740709	8-1963	57 RdeV	Silver overall. Noted 2006 preserved Boboc, Ianca, as 709 Black in Lancer C-style grey camouflage, black 'Forțele Aeriene Române' titles
710	MiG-21F-13	740710	8-1963	57 RdeV	
711	MiG-21F-13	740711	8-1963	57 RdeV	Preserved Bucharest-Otopeni airport
712	MiG-21F-13	740712	8-1963	57 RdeV	
713	MiG-21F-13	740713	8-1963	57 RdeV	
714	MiG-21F-13	740714	8-1963	57 RdeV	Preserved Bucharest-Otopeni airport
715	MiG-21F-13	740715	8-1963	57 RdeV	
801	MiG-21F-13	740801	8-1963	57 RdeV	To 86 RdeV, noted 2006 preserved Borcea-Fetești AB

◄
The MiG-21F-13 remained in RoAF service long enough to receive the current roundels that replaced the communist-era star-type insignia in 1984. Very faded Moscow-built '705 Red' is seen at the Deveselu storage depot in 2006.

Gor'kiy-built MiG-21F-13 '20 Red' (also stored at Deveselu) gained a special colour scheme at the end of its flying career.
▼◄

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►
MiG-21PFM '4715 Red' serves as a ground instructional airframe at the technical college at Boboc-Ianca AB.

Romanian Air Force MiG-21PFs

Serial	Version	C/n	Delivered	First Unit	Comments
401	MiG-21PF	761401	7-1965		
403 Red	MiG-21PF	761403	7-1965		Grey overall. Noted 2006 stored CMA 322 Craiova
404 Red	MiG-21PF	761404	7-1965		Grey overall. Noted 2004 stored CMA 322 Craiova, but believed subsequently scrapped
405 Red	MiG-21PF	761405	7-1965		Grey overall. Noted 2006 stored CMA 322 Craiova
406 Red	MiG-21PF	761406	7-1965		Grey overall. Noted 2006 stored CMA 322 Craiova
407	MiG-21PF	761407	7-1965		Noted 2006 stored Bacău
408 Red	MiG-21PF	761408	7-1965		Grey overall. Noted 2007 stored CMA 322 Craiova
409	MiG-21PF	761409	7-1965		
410 Red	MiG-21PF	761410	7-1965		Grey overall. Noted 2006 stored CMA 322 Craiova
411 White outline	MiG-21PF	761411	7-1965		Grey overall. Noted 2006 stored Deveselu
412 Red	MiG-21PF	761412	7-1965		Grey overall. Noted 2006 stored Deveselu
413 Red	MiG-21PF	761413	7-1965		Silver overall. Noted 2006 stored Deveselu
414 Red	MiG-21PF	761414	7-1965		Silver overall, later grey overall. Noted 2006 stored Deveselu
415 White outline	MiG-21PF	761415	7-1965		Grey overall. Noted 2006 stored Deveselu
501 Red	MiG-21PF	761501	7-1965		Silver overall. Noted 2006 stored Deveselu
502	MiG-21PF	761502	7-1965		
503 White outline	MiG-21PF	761503	7-1965		Grey overall. Noted 2006 stored CMA 322 Craiova; see also MiG-21M table
504 White outline	MiG-21PF	761504	7-1965		Grey overall. Noted 2006 stored Deveselu
505 White outline	MiG-21PF	761505	7-1965		Grey overall. Noted 2006 stored Deveselu
507 Red	MiG-21PF	761507	7-1965		Grey overall. Noted 2006 stored CMA 322 Craiova
508 White outline	MiG-21PF	761508	7-1965		Grey overall. Noted 2006 stored CMA 322 Craiova
509 Red	MiG-21PF	761509	7-1965		Grey overall. Noted 2006 stored CMA 322 Craiova
510 White outline	MiG-21PF	761510	7-1965		Grey overall
609	MiG-21PF	761609	7-1965		Noted 2006 stored Deveselu
705	MiG-21PF	760705	1-1965	86 RdeV	
706 Red	MiG-21PF	760706	1-1965	86 RdeV	Grey overall. Noted 2006 stored CMA 322 Craiova Base
707	MiG-21PF	760707	1-1965	86 RdeV	Not seen since 1998, probably subsequently scrapped
708 Red	MiG-21PF	760708	1-1965	86 RdeV	Grey overall. Noted 2004, but not 2006, stored CMA 322 Craiova Base, probably subsequently scrapped
709	MiG-21PF	760709	1-1965	86 RdeV	Noted 2004 stored CMA 322 Craiova Base, probably subsequently scrapped
710	MiG-21PF	760710	1-1965	86 RdeV	Noted 2006 stored CMA 322 Craiova Base
711 Red	MiG-21PF	760711	1-1965	86 RdeV	Grey overall. Noted 2006 stored CMA 322 Craiova Base; 7-2007 noted at *Muzeul Aviației*, Bucharest
712	MiG-21PF	760712	1-1965	86 RdeV	Noted 1998 stored Bacău probably subsequently scrapped
713 Red	MiG-21PF	760713	1-1965	86 RdeV	Grey overall. Noted 2004, but not 2006, stored CMA 322 Craiova Base, probably subsequently scrapped
714 Red	MiG-21PF	760714	1-1965	86 RdeV	Grey overall. Noted 2006 stored CMA 322 Craiova Base; 7-2007 noted at *Muzeul Aviației*, Bucharest
715 Red	MiG-21PF	760715	1-1965	86 RdeV	Grey overall. Noted 2006 stored CMA 322 Craiova Base
801	MiG-21PF	760801	1-1965	86 RdeV	To RdeV 67
802	MiG-21PF	760802	1-1965	86 RdeV	Noted 2006 stored CMA 322 Craiova Base
803	MiG-21PF	760803	1-1965	86 RdeV	Not seen since 1997, probably subsequently scrapped

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BdeV at Giarmata, a regiment equipped exclusively with the MiG-21MF.

Surprisingly, at least two Lancer Cs (5724 Black and 6305 Black) have been seen carrying a laser designator pod associated with ground attack on the centreline pylon in spite of their air superiority role.

The first trainers arrived in Romania in 1965 about three years after the first MiG-21F-13. They were four MiG-21U (*izdeliye* 66-400) two-seaters, the first of four trainer variants, and were followed shortly afterwards by three MiG-21U (*izdeliye* 66-600), which had a broader tailfin with the parabrake just below the rudder.

The MiG-21US (*izdeliye* 68A) had blown flaps and late production also sported a forward looking periscope on the canopy top for the convenience of the instructor in the rear seat. 14 were delivered to Romania starting in 1969.

The final version of the trainer was the MiG-21UM (*izdeliye* 69) which had updated instruments. Externally it differed from the late-model MiG-21US by having an angle of attack sensor on the port side of the nose and a dorsal aerial in front of the tailfin. 31 were delivered between 1972 and 1980. 14 of these were converted to Lancer B standard; the first flight of this version took place on 6th May 1996. Lancer Bs normally wear a light green/dark green/dark earth/tan camouflage with blue undersurfaces, a silver nose and, occasionally, white *Forțele Aeriene Române* titles.

All four trainer variants were known locally as the **MiG-21DC** (for *dubla comanda* – dual controls).

Although the RoAF did not operate the MiG-21*bis* (*izdeliye* 75A), a single example appeared at the 43rd Paris Air Salon in 1999 in RoAF colours and roundels with the exhibit code 362. It was 165 Black (c/n 75001012, f/n 0102), the Lancer III prototype owned by Aerostar and currently stored at Bacău, where it was hoped that future upgrades for countries operating the MiG-21*bis* would be performed.

One story in circulation suggests the RoAF was denied possession of any MiG-21*bis* fighters because the Kremlin heard that in 1976 Chinese technicians had been allowed to inspect a MiG-21MF too closely.

▲▲
A typical propaganda shot showing the pilot of a Romanian MiG-21PF, '414 Red', being greeted by his colleague – wearing a different type of helmet.

◄▲
Romanian MiG-21PFMs in old-style insignia. Note that the stars were not applied to the wings.

MiG-21PF '406 Red' in 1984-standard Romanian Air Force insignia CMA 322, Craiova, 2006

MiG-21PFM (*izdeliye* 94N) '8004 Red', CMA 322, Craiova, 2004

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◄ **'4707 Red', the first MiG-21PFM (*izdeliye* 94A) delivered to Romania, awaits its fate at the Deveselu storage facility in 2006. The insignia on individual aircraft show different degrees of weathering.**

The 2007 RoAF order of battle involving MiG-21 fighters and trainers is:

Câmpia Turzii, Baza 71 Aeriana:

• 711 *Escadrila Avione Vânătoare* (EAvV – Fighter Squadron) MiG-21 Lancer A and B;

• 712 EAvV MiG-21 Lancer B and C.

Borcea-Feteşti, Baza 86 Aeriana:

• 861 EAvV MiG-21 Lancer B and C;

• 862 EAvV MiG-21 Lancer A and B;

• 863 EAvV MiG-21 Lancer A and B detached to Mihail Kogălniceanu AB.

Bacău, Baza 95 Aeriana:

• 951 EAvV MiG-21 Lancer A, B and C;

• 205 *Escadrila Aviaţie Scoala* (Training Air Squadron), MiG-21 Lancer A and B.

Slovakia

After Czechoslovakia was split into two the Slovak Republic formed on 1st January 1993 the **Air Force and Air Defence Force of the Slovak Republic** (*Letectvo a Protivzdušná obrana armády Slovenskej Republiky*), which was

Romanian Air Force MiG-21PFMs

Serial	Version	C/n	Delivered	Comments
4707 Red	MiG-21PFM (*izd.* 94A)	94A4707	1966	Grey overall. Noted 2006 stored Deveselu
4708 Red	MiG-21PFM (*izd.* 94A)	94A4708	1966	Silver overall. Noted 2004, but not 2006, stored CMA 322 Craiova Base, probably subsequently scrapped
4709 Red (1)	MiG-21PFM (*izd.* 94A)	94A4709	1966	Silver overall, later grey overall, very crude insignia. Noted 2006 stored CMA 322 Craiova; see MiG-21US table
4710 Red	MiG-21PFM (*izd.* 94A)	94A4710	1966	Grey overall. Noted 2006 stored CMA 322 Craiova
4711 Red	MiG-21PFM (*izd.* 94A)	94A4711	1966	Silver overall, later repainted grey overall as 4711 White outline. Noted 2006 stored Deveselu
4712 Red	MiG-21PFM (*izd.* 94A)	94A4712	1966	Grey overall. Noted 2006 stored Deveselu
4713 Red	MiG-21PFM (*izd.* 94A)	94A4713	1966	Grey overall, very crude insignia. Noted 2006 stored CMA 322 Craiova
4714 Red	MiG-21PFM (*izd.* 94A)	94A4714	1966	Grey overall. Noted 2006 stored CMA 322 Craiova
4715 Red	MiG-21PFM (*izd.* 94A)	94A4715	1966	Silver overall. Noted 2006 preserved Borcea-Feteşti as GIA, noted 7-2007 at a Training College at Boboc as GIA
4801 Red	MiG-21PFM (*izd.* 94A)	94A4801	1966	Silver overall, later grey overall. Noted 2006 stored CMA 322 Craiova
4802 Red	MiG-21PFM (*izd.* 94A)	94A4802	1966	Grey overall. Noted 2006 stored CMA 322 Craiova
4803 Red	MiG-21PFM (*izd.* 94A)	94A4803	1966	Grey overall. Noted 2006 stored CMA 322 Craiova
4804	MiG-21PFM (*izd.* 94A)	94A4804	1966	To RdeV 67
4907 Red	MiG-21PFM (*izd.* 94A)	94A4907	11-1967	Grey overall. Noted 2006 stored CMA 322 Craiova
5809	MiG-21PFM (*izd.* 94A)	94A5809	11-1967	Noted 2006 stored CMA 322 Craiova
5810	MiG-21PFM (*izd.* 94A)	94A5810	11-1967	
5811 Red	MiG-21PFM (*izd.* 94A)	94A5811	11-1967	Grey overall. Noted 2006 stored CMA 322 Craiova
5812	MiG-21PFM (*izd.* 94A)	94A5812	11-1967	
5813	MiG-21PFM (*izd.* 94A)	94A5813	11-1967	Noted 2006 stored CMA 322 Craiova
5814 Red	MiG-21PFM (*izd.* 94A)	94A5814	11-1967	Grey overall. Noted 2006 stored CMA 322 Craiova
5815 Red	MiG-21PFM (*izd.* 94A)	94A5815	11-1967	Grey overall. Noted 2004, but not 2006, stored CMA 322 Craiova, probably subsequently scrapped
5903 Red	MiG-21PFM (*izd.* 94A)	94A5903	11-1967	Grey overall. Noted 2006 stored CMA 322 Craiova
5904 White outline	MiG-21PFM (*izd.* 94A)	94A5904	11-1967	Grey overall. Noted 2006 stored Deveselu
5906	MiG-21PFM (*izd.* 94A)	94A5906	11-1967	Noted 2006 stored CMA 322 Craiova
5907	MiG-21PFM (*izd.* 94A)	94A5907	11-1967	Noted 2006 stored CMA 322 Craiova
5908 Red	MiG-21PFM (*izd.* 94A)	94A5908	11-1967	Grey overall. Noted 2006 stored CMA 322 Craiova
5909 Red	MiG-21PFM (*izd.* 94A)	94A5909	11-1967?	Grey overall. Noted 2006 stored CMA 322 Craiova
5910 Red	MiG-21PFM (*izd.* 94A)	94A5910	11-1967?	Grey overall. Noted 2006 stored CMA 322 Craiova
6405 Red	MiG-21PFM (*izd.* 94A)	94A6405	2-1968	Grey overall. Noted 2004, but not 2006, stored CMA 322 Craiova, probably subsequently scrapped
8003 Red	MiG-21PFM (*izd.* 94N)	94N003	2-1968	Grey overall. Noted 2005 stored CMA 322 Craiova
8004 Red	MiG-21PFM (*izd.* 94N)	94N8004	2-1968	Grey overall. Noted 2004, but not 2006, stored CMA 322 Craiova, probably subsequently scrapped
8005 Red	MiG-21PFM (*izd.* 94N)	94N8005	2-1968	Silver overall. Preserved Boboc Base Museum
8006 White	MiG-21PFM (*izd.* 94N)	94N8006	2-1968	Dark green/light green/dark earth/tan camouflage. Noted 2006 stored Deveselu
8007 Red	MiG-21PFM (*izd.* 94N)	94N8007	2-1968	Grey overall. Noted 2006 stored CMA 322 Craiova
8008 Red	MiG-21PFM (*izd.* 94N)	94N8008	2-1968	Grey overall. Noted 2006 stored CMA 322 Craiova
8009	MiG-21PFM (*izd.* 94N)	94N8009	2-1968	
8010	MiG-21PFM (*izd.* 94N)	94N8010	2-1968	
8011	MiG-21PFM (*izd.* 94N)	94N8011	2-1968	Noted 2007 preserved Borcea-Feteşti as '2004'
8012 Red	MiG-21PFM (*izd.* 94N)	94N8012	2-1968	Grey overall. Noted 2006 stored CMA 322 Craiova
8013	MiG-21PFM (*izd.* 94N)	94N8013	2-1968	
8014	MiG-21PFM (*izd.* 94N)	94N8014	2-1968	Noted 2006 stored CMA 322 Craiova
8015 Red	MiG-21PFM (*izd.* 94N)	94N8015	2-1968	Grey overall. Noted 2006 stored CMA 322 Craiova
8101	MiG-21PFM (*izd.* 94N)	94N8101	2-1968	Noted 2006 stored CMA 322 Craiova
8102 Red (1)	MiG-21PFM (*izd.* 94N)	94N8102	2-1968	Grey overall. Noted 2006 stored Deveselu; see MiG-21MF table
8103 Red (1)	MiG-21PFM (*izd.* 94N)	94N8103	2-1968	Grey overall. Noted 2006 stored Deveselu; see MiG-21MF table
8104 (1)	MiG-21PFM (*izd.* 94N)	94N8104	2-1968	See MiG-21MF
8105 Red (1)	MiG-21PFM (*izd.* 94N)	94N8105	2-1968	Grey overall. Noted 2006 stored CMA 322 Craiova Base; see MiG-21MF table
8106 (1)	MiG-21PFM (*izd.* 94N)	94N8106	2-1968	Noted 2004, but not 2006, stored CMA 322 Craiova, probably subsequently scrapped; see MiG-21MF table
8107 (1)	MiG-21PFM (*izd.* 94N)	94N8107	2-1968?	See MiG-21MF table
8108 Red	MiG-21PFM (*izd.* 94N)	94N8108	2-1968	Grey overall. Noted 2006 stored CMA 322 Craiova
8109	MiG-21PFM (*izd.* 94N)	94N8109	2-1968?	
8110 Red	MiG-21PFM (*izd.* 94N)	94N8110	2-1968	Grey overall. Noted 2006 stored CMA 322 Craiova

Romanian Air Force MiG-21Rs

Serial	Version	C/n	Delivered	First Unit	Comments
1503 Red	MiG-21R	94R01503	12-1968	EdeR 31	Grey overall. Decommissioned 1998, noted 2006 stored CMA 322 Craiova
1504 Red	MiG-21R	94R01504	12-1968	EdeR 31	Grey overall. Decommissioned 1998, noted 2006 stored CMA 322 Craiova
1907 Red	MiG-21R	94R01907	9-1970	EdeR 31	Grey overall. Decommissioned 1998, noted 2007 stored CMA 322 Craiova
1908 Red	MiG-21R	94R01908	9-1970	EdeR 31	Grey overall. Decommissioned 1998, noted 2006 stored CMA 322 Craiova
1910 Red	MiG-21R	94R01910	9-1970	EdeR 31	Grey overall. Decommissioned 1998, noted 2006 stored CMA 322 Craiova
2003 Red	MiG-21R	94R20003	1972	EdeR 31	Grey overall. Decommissioned 1998, noted 2006 stored CMA 322 Craiova
2007 Red	MiG-21R	94R20007	1972	EdeR 31	Grey overall. Decommissioned 1998, noted 2006 stored CMA 322 Craiova, 7-2007 noted at *Museul Aviației*, Bucharest
2011 Red	MiG-21R	94R20011	1972		Silver overall, old insignia. Fate unknown
2017	MiG-21R	94R20017	1972	EdeR 31	Probably crashed
2023 Red	MiG-21R	94R20023	1972	EdeR 31	Grey overall. Decommissioned 1998, noted 2006 stored CMA 322 Craiova
2043 Red	MiG-21R	94R20403	1972	EdeR 31	Grey overall. Decommissioned 1998, noted 2006 stored CMA 322 Craiova

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◄ **Many of the Romanian MiG-21Ms were upgraded to Lancer A/C standard, but not '503 Red', which is seen here in storage at the deactivated Deveselu AB in 2006.**

Romanian Air Force MiG-21Ms

Serial	Version	C/n	Delivered	Comments
211 Black	MiG-21M	961211	8-1969	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
212 Black	MiG-21M	961212	8-1969	**Lancer A**, BdeV 95
213 Black	MiG-21M	961213	8-1969	**Lancer A**, BdeV 95
214	MiG-21M	961214	8-1969	
215 Black	MiG-21M	961215	8-1969	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
301 Black	MiG-21M	961301	8-1969	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
302	MiG-21M	961302	8-1969	
303	MiG-21M	961303	8-1969	
304 Black	MiG-21M	961304	8-1969	**Lancer A**, EdeV 862, noted active 27-6-2007 Borcea-Fetești AB
305 Black	MiG-21M	961305	8-1969	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
306	MiG-21M	961306	8-1969	
307	MiG-21M	961307	8-1969	
308	MiG-21M	961308	8-1969	
503 Red	MiG-21M	961503	9-1969	Grey overall. 91 BdeV, noted 2006 stored at the closed Deveselu base
504 Red	MiG-21M	961504	9-1969	Grey overall. Noted 2006 stored CMA 322 Craiova
505	MiG-21M	961505	9-1969	
506 Black	MiG-21M	961506	9-1969	**Lancer A**, BdeV 95
507 Red	MiG-21M	961507	9-1969	Grey overall. Noted 2007 stored CMA 322 Craiova
642 Black	MiG-21M	?		**Lancer A**
708	MiG-21M	962708		
709	MiG-21M	962709	9-1970	
710	MiG-21M	962710	9-1970	**Lancer A**, EdeV 862, noted WFU 2006
711 Black	MiG-21M	962711	9-1970	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău

▲ The badge of the 86 Fighter Regiment/1st Sqn (EdeV 861).

▲ The badge of the 86 Fighter Regiment/2nd Sqn (EdeV 862).

▲ The badges of the1st (above) and 2nd Sqns of the another Romanian Air Force MiG-21 unit. ▼

► MiG-21MF Lancer C '5724 Black' of EdeV 862 illustrates the air defence version's colours.

712	MiG-21M	962712	9-1970	**Lancer A**, BdeV 95, noted active 27-6-2007 Borcea-Fetești AB, EdeV 862
713 Black	MiG-21M	962713	9-1970	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
714 Black	MiG-21M	962714	9-1970	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
715 Black	MiG-21M	962715	9-1970	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
801 Black	MiG-21M	962801	9-1970	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
802	MiG-21M	962802	9-1970	
803 Black	MiG-21M	962803	9-1970	**Lancer A**, BdeV 95, noted 2006 stored Bacău
804 Black	MiG-21M	962804	9-1970	**Lancer A**, EdeV 862, noted active 27-6-2007 Borcea-Fetești AB
805 Red	MiG-21M	962805	9-1970	Grey overall. Noted 2006 stored CMA 322 Craiova
806 Black	MiG-21M	962806	9-1970	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
807 Red	MiG-21M	962807	9-1970	Grey overall. 91 BdeV, noted 2006 stored at the closed Deveselu base
808 Black	MiG-21M	962808	9-1970	**Lancer A** EdeV 862, noted active 27-6-2007 Borcea-Fetești AB
809	MiG-21M	962809	9-1970	91 BdeV, noted 2006 stored at the closed Deveselu base, possibly now scrapped
810 Black	MiG-21M	962810	9-1970	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
811	MiG-21M	962811	9-1970	**Lancer A**, EdeV 951
812 Black	MiG-21M	962812	9-1970	**Lancer A**, EdeV 862, noted active 27-6-2007 Borcea-Fetești AB
813	MiG-21M	962813	9-1970	BdeV 67
814	MiG-21M	962814	9-1970	
815 Black	MiG-21M	962815	9-1970	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
901 Black	MiG-21M	962901	9-1970	**Lancer A**, BdeV 95, noted active 26-6-2007 Borcea-Fetești AB
902	MiG-21M	962902	9-1970	**Lancer A**, EdeV 862, noted active 27-6-2007 Borcea-Fetești AB
903 Black	MiG-21M	962903	9-1970	Lancer A style four-tone camouflage, 'Forțele Aeriene Române' titles. Noted 2006 as instructional airframe at a Training College at Boboc, named 'Dolly'
904 Black	MiG-21M	962904	9-1970	**Lancer A**, EdeV 862
905	MiG-21M	962905	9-1970	
906	MiG-21M	962906	9-1970	**Lancer A**, EdeV 862, noted 27-6-2007 Borcea-Fetești AB, EdeV 862
907 Black	MiG-21M	962907	9-1970	**Lancer A**, BdeV 95, noted 2004 stored 26-6-2007 active Bacău, EdeV 202
908 Black	MiG-21M	962908	9-1970	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
909	MiG-21M	962909	9-1970	
910	MiG-21M	962910	9-1970	BdeV 95, noted 1998 stored Bacău, not present 2004, probably scrapped
911	MiG-21M	962911	9-1970	**Lancer A**, EdeV 862
912	MiG-21M	962912	9-1970	RdeV 67
913	MiG-21M	962913	9-1970	**Lancer A**, EdeV 862
914	MiG-21M	962914	9-1970	
915	MiG-21M	962915	9-1970	
3001 Black	MiG-21M	963001	9-1970	**Lancer A**, EdeV 711, noted 25-6-2007 active Câmpia Turzii 25-6-2007, EdeV 711
3002 Black	MiG-21M	963002	9-1970	**Lancer A**, EdeV 711, noted 25-6-2007 active Câmpia Turzii 25-6-2007, EdeV 711
3003	MiG-21M	963003	9-1970	**Lancer A**, EdeV 711, noted 25-6-2007 active Câmpia Turzii 25-6-2007, EdeV 711

Marcus Fulber

Romanian Air Force MiG-21MFs

Serial	Version	C/n	Line number	Date of delivery	Comments
5705 Black	MiG-21MF *	96005705	0417?	9-1975	**Lancer A**, BdeV 95, noted 2006 Bacău
5724 Black	MiG-21MF *	96005724	0418	9-1975	**Lancer C**, EdeV 862, noted 2006 Borcea-Feteşti
5788 Black	MiG-21MF *	96005788	0419	9-1975	**Lancer C**, EdeV 862, noted active 27-6-2007 Borcea-Feteşti AB, EdeV 861
5801 Black	MiG-21MF *	96005801	0420	9-1975	**Lancer C**, EdeV 862, noted active 27-6-2007 Borcea-Feteşti AB, EdeV 861
5819 Black	MiG-21MF *	96005819	0421?	9-1975	**Lancer C**, EdeV 712, crashed 26-8-2004 after collision with 6700, wreck at Câmpia Turzii 2006
5834 Black	MiG-21MF *	96005834	0422?	9-1975	**Lancer C**, EdeV 862, noted 2006 Borcea-Feteşti
5902 Black	MiG-21MF *	96005902	0423?	9-1975	BdeVB 91, shown unmodified by IAI as MiG-21-2000 at Paris Air Salon 1993, subsequently reported crashed
5907 Black	MiG-21MF	965907		1972-4	**Lancer A**, BdeV 95, crashed 23-10-2002
5908 Black	MiG-21MF	965908		1972-4	**Lancer A**, BdeV 95, noted 2006 Bacău
5910 Black	MiG-21MF	965910		1972-4	**Lancer A**, BdeV 95, noted 2006 Bacău
5911 Black	MiG-21MF	965911		1972-4	**Lancer A**, BdeV 95, noted 2006 Bacău
5912 Black	MiG-21MF	965912		1972-4	**Lancer A**, BdeV 95, noted 2006 Bacău
5913 Black	MiG-21MF	965913		1972-4	**Lancer A**, BdeV 95, noted 2006 Bacău
5914	MiG-21MF	965914		1972-4	BdeV 95, noted 1998 stored Bacău, not there 2004
5915 Black	MiG-21MF	965915		1972-4	**Lancer A**, BdeV 95, noted 2006 stored Bacău
5917 Black	MiG-21MF *	96005917	0424?	9-1975	**Lancer C**, EdeV 712, reported stored Câmpia Turzii 2005; noted active Câmpia Turzii 25-6-2007
6001 Black	MiG-21MF	966001		1972-4	**Lancer A**, BdeVB 86, crashed 21-2-2002, wreck at Borcea-Feteşti 2006
6002 Black	MiG-21MF	966002		1972-4	**Lancer C**, EdeV 712, reported stored Câmpia Turzii 2005; noted active Câmpia Turzii 25-6-2007, EdeV 711
6003 Black	MiG-21MF	966003		1972-4	**Lancer A**, EdeV 712, reported stored Câmpia Turzii 2005; noted active Câmpia Turzii 25-6-2007, EdeV 711
6010 Black	MiG-21MF *	96006010	0425?	9-1975	**Lancer C**, EdeV 861, noted 2004 Borcea-Feteşti, noted active 27-6-2007 Borcea-Feteşti AB EdeV 861
6025 Black	MiG-21MF *	96006025	0501?	9-1975	**Lancer C**, EdeV 712, crashed 25-9-2003, wreck at Câmpia Turzii 2006
6040	MiG-21MF *	96006040	0502?	9-1975	BdeVB 93, noted 2006 as gate guard at Timişoara
6105 Black	MiG-21MF *	96006105	0503?	9-1975	**Lancer C**, EdeV 712, noted active Câmpia Turzii 25-6-2007
6196 Black	MiG-21MF *	96006196	0504?	9-1975	**Lancer C**, EdeV 712, noted active Câmpia Turzii 25-6-2007
6203 Black	MiG-21MF *	96006203	0505?	9-1975	**Lancer C**, EdeV 712, noted active Câmpia Turzii 25-6-2007
6207 Black	MiG-21MF *	96006207	0506?	9-1975	**Lancer C**, EdeV 861, noted active 27-6-2007 Borcea-Feteşti AB
6305 Black	MiG-21MF *	96006305	0507	9-1975	**Lancer C**, black 'Forţele Aeriene Române' titles. EdeV 861, noted 2006 Borcea-Feteşti
6413 Black	MiG-21MF *	96006413	0510?	9-1975	**Lancer C**, EdeV 861, crashed 8-3-2005
6421 Black	MiG-21MF *	96006421	0511?	9-1975	**Lancer A**, EdeV 711, noted active Câmpia Turzii 25-6-2007
6487 Black	MiG-21MF *	96006487	0512?	9-1975	**Lancer C**, EdeV 861, noted active 27-6-2007 Borcea-Feteşti AB
6499 Black	MiG-21MF *	96006499	0513?	9-1975	**Lancer C**, EdeV 712, noted 25-6-2007 active Câmpia Turzii
6503 Black	MiG-21MF *	96006503	0514?	9-1975	**Lancer A**, EdeVD 862, noted 27-6-2007 stored Borcea-Feteşti
6518 Red	MiG-21MF *	96006518	0515	9-1975	Grey overall. Converted to Lancer C 6518 Black, EdeV 712, noted 2006 Câmpia Turzii with unit badge, noted active 27-6-2007
6581 Black	MiG-21MF *	96006581	0516	9-1975	**Lancer A**, EdeVD 862, noted 27-6-2007 stored Borcea-Feteşti
6607 Black	MiG-21MF *	96006607	0517	9-1975	Prototype Lancer C, first flight 6-11-1996. EdeV 712, noted 25-6-2007 active Câmpia Turzii
6693 Black	MiG-21MF *	96006693	0518	9-1975	**Lancer A**, EdeVD 862, noted 27-6-2007 stored Borcea-Feteşti; noted 26-6-2007 stored Bacău
6700 Black	MiG-21MF *	96006700	0519	9-1975	**Lancer C**, EdeV 712, crashed 26-8-2004 after collision with 5819, wreck at Câmpia Turzii 2006
6707 Black	MiG-21MF *	96006707	0520	9-1975	**Lancer C**, EdeV 861, noted active 27-6-2007 Borcea-Feteşti
6721 Black	MiG-21MF *	96006721	0521	9-1975	First production Lancer C, Le Bourget exhibit code 332, white 'Forţele Aeriene Române' titles. EdeV 712. Crashed 27-11-2006
6801 Black	MiG-21MF *	96006801	0522	9-1975	**Lancer A**, EdeVB 711, noted active 25-6-2007 Câmpia Turzii
6807 Black	MiG-21MF *	96006807	0523	9-1975	**Lancer C**, EdeV 861, noted 2006 Borcea-Feteşti
6824 Black	MiG-21MF *	96006824	0524?	9-1975	**Lancer C**, EdeV 861, noted 2006 Borcea-Feteşti
6840 Black	MiG-21MF *	96006840	0525?	9-1975	**Lancer C**, EdeV 712, noted active 25-6-2007 Câmpia Turzii
7011 Black	MiG-21MF *	96007011	0601?	9-1975	**Lancer A**, BdeV 95, noted 2006 Bacău
7017 Black	MiG-21MF *	96007017	0602?	9-1975	**Lancer C**, crashed 13-7-2001
8102 Black (2)	MiG-21MF	968102		1972-4	**Lancer A**, EdeVB 711, noted active 25-6-2007 Câmpia Turzii; see MiG-21PFM table
8103 Black (2)	MiG-21MF	968103		1972-4	**Lancer A**, BdeV 95, noted active Bacău 26-6-2007; see MiG-21PFM table
8104 Black (2)	MiG-21MF	968104		1972-4	**Lancer A**, EdeVB 711, noted active 25-6-2007 Câmpia Turzii; see MiG-21PFM table
8105 Black (2)	MiG-21MF	968105		1972-4	**Lancer A**, BdeV 95, noted 2006 Bacău; see MiG-21PFM table
8106 (2)	MiG-21MF	968106		1972-4	See MiG-21PFM table

8107 Black (2)	MiG-21MF	968107		1972-4	**Lancer A**, BdeV 95, noted 2006 Bacău; see MiG-21PFM table
9607	MiG-21MF	969607		1972-4	**Lancer A**, EdeVB 711, noted active 25-6-2007 Câmpia Turzii
9608	MiG-21MF	969608		1972-4	**Lancer A**, EdeVB 711, noted active 25-6-2007 Câmpia Turzii
9609	MiG-21MF	969609		1972-4	
9610 Black	MiG-21MF	969610		1972-4	**Lancer A**, BdeV 95, noted active 26-6-2007 Bacău
9611 Black	MiG-21MF	969611		1972-4	**Lancer C**, EdeV 712, last Lancer conversion delivered 16-4-2003, noted active 25-6-2007 Câmpia Turzii
9612	MiG-21MF	969612		1972-4	**Lancer A**, EdeVB 711, noted active 25-6-2007 Câmpia Turzii
9613 Red	MiG-21MF	969613		1972-4	Grey overall. To Lancer A '9613 Black', BdeV 95, noted 2006 Bacău
9614 Red	MiG-21MF	969614		1972-4	Grey overall. Noted 2006 stored Deveselu damaged after nosewheel collapsed
9615 Red	MiG-21MF	969615		1972-4	Grey overall. Lancer A, EdeVB 711, noted active 25-6-2007 Câmpia Turzii
9701 Black	MiG-21MF	969701		1972-4	**Lancer A**, noted 2004 and 7-2007 as ground instructional airframe at Boboc
9702	MiG-21MF	969702		1972-4	**Lancer A**, EdeVB 711, noted active 25-6-2007 Câmpia Turzii
9703	MiG-21MF	969703		1972-4	**Lancer A**, EdeVB 711, noted active 25-6-2007 Câmpia Turzii
9704	MiG-21MF	969704		1972-4	
9705 Black	MiG-21MF	969705		1972-4	**Lancer A**, EdeVB 711, noted active 25-6-2007 Câmpia Turzii
9806 Red	MiG-21MF	969806		1972-4	Grey overall. **Lancer A**, EdeVD 862, noted 27-6-2007 stored Borcea-Fetești
9807 Black	MiG-21MF	969807		1972-4	Lancer C-style grey camouflage, black 'Forțele Aeriene Române' titles. Noted 2006 as GIA at Boboc-Ianca
9808 Black	MiG-21MF	969808		1972-4	**Lancer A**, EdeVB 711, noted active 25-6-2007 Câmpia Turzii
9809	MiG-21MF	969809		1972-4	**Lancer A**, BdeV 95, noted 26-6-2007 stored Bacău
9810	MiG-21MF	969810		1972-4	**Lancer A**, EdeVB 711, noted active 25-6-2007 Câmpia Turzii
9811	MiG-21MF	969811		1972-4	**Lancer A**, EdeVB 711, crashed 26-3-2002

Romanian Air Force MiG-21U trainers

Serial	Version	C/n	Delivered	Comments
1120 Red	MiG-21U (*izd.* 66-400)	661120	5-1965	Silver overall, old insignia; later grey overall. Noted 2006 stored at Craiova, 7-2007 noted at *Muzeul Aviației*, Bucharest
1216 Black	MiG-21U (*izd.* 66-400)	661216	5-1965	Lancer B-style four-tone camouflage. Noted 2006 stored at Craiova
1716	MiG-21U (*izd.* 66-400)	661716	12-1965	
1717 Red	MiG-21U (*izd.* 66-400)	661717	12-1965	Silver overall. Noted 2006 stored at Deveselu
3516 Red	MiG-21U (*izd.* 66-600)	663516	10-1966	Grey overall. Noted 2006 stored at Craiova
3517 Red	MiG-21U (*izd.* 66-600)	663517	10-1966	Grey overall. Noted 2007 stored at Craiova
5117 Red	MiG-21U (*izd.* 66-600)	665117	2-1968	Silver overall. Noted 2006 stored Deveselu. Reported to have c/n 675117 erroneously marked on the airframe as MiG-OKB denies ever using *izdeliye* 67 for MiG-21U (*izdeliye* 66-600)

Chris Lofting

▲

MiG-21M Lancer A '904 Black' of EdeV 862 taxies at Borcea-Fetești AB, showing the tactical camouflage characteristic of the strike version.

Romanian Air Force MiG-21USs

Serial	Version	C/n	Delivered	Comments
3406 Red	MiG-21US	06685134	1969	Grey overall. Noted 2004 stored at Craiova but not in 2006, probably scrapped
3407	MiG-21US	07685134		
3408	MiG-21US	08685134		
3409	MiG-21US	09685134		
3410	MiG-21US	10685134		
3908	MiG-21US	08685139		Noted 1995 stored at Bacău but not in 2006, probably scrapped
3910 Red	MiG-21US	10685139		Grey overall. Noted 2006 stored at Deveselu
4107	MiG-21US	07685141		
4109 Red	MiG-21US	09685141		Grey overall. Noted 2006 stored at Deveselu
4309	MiG-21US	09685143		Noted 1990 stored at Bacău but not in 2006, probably scrapped
4703 Red	MiG-21US	03685147		Grey overall. Noted 2006 stored at Deveselu
4708	MiG-21US	08685147		Noted 2006 stored at Craiova
4709 Red	MiG-21US	09685147		Grey overall. Noted 2005 stored at Craiova but not in 2006, probably scrapped

Romanian Air Force MiG-21UMs

Serial	Version	C/n	Delivered	Unit	Comments
061	MiG-21UM	516999061?	c.1991	91 BdeV	**Lancer B**, BdeV 95, noted 2006 Bacău
071	MiG-21UM	516999071?	c.1991	91 BdeV	**Lancer B**, BdeV 95, noted 2006 Bacău, noted 26-6-2007 active at Bacău, 202 EdeV
172	MiG-21UM	516999172	c.1991	91 BdeV	**Lancer B**, BdeV 95, BdeV 71, noted active 25-6-2007 Câmpia Turzii
176 Black	MiG-21UM	516999176	c.1991	91 BdeV	**Lancer B**, BdeV 71, noted active 25-6-2007 Câmpia Turzii
177 Red	MiG-21UM	516999177	c.1991	91 BdeV	Grey overall; to **Lancer B** '177 Black', BdeV 95, noted active 26-6-2007 Bacău, 951 EdeV
326	MiG-21UM	516999326	9-1980	RdeV 86	Crashed 1984
327 Black	MiG-21UM	516999327	9-1980		**Lancer B**, prototype first flight 6-5-1996, BdeV 95, noted active 26-6-2007 Bacău, 202 EdeV
328	MiG-21UM	516999328	9-1980		RdeV 91, crashed 13-4-1993
329	MiG-21UM	516999329	9-1980		**Lancer B**, BdeV 71
339	MiG-21UM	516999339	9-1980		Noted 2001, stored at Aerostar, not now RoAF
6901	MiG-21UM	01695166?	6 to 7-1972		C/n may be 01695169! Noted 2006 stored at Aerostar
6904 Red	MiG-21UM	04695169	1972		Grey overall. Noted 26-6-2007 stored at Aerostar facility, Craiova
6905	MiG-21UM	05695169	1972	RdeV 67	Not noted since 1991, believed scrapped
6906	MiG-21UM	06695167	1972		Serial probably mispainted and should be 6706 (c/n 06695169 is a Soviet Air Force example!) BdeV 91, BdeV 86, noted 2006 stored Craiova
6907 Black	MiG-21UM	07695169	1972		**Lancer B**, BdeV 95, BdeV 86, noted 27-6-2007 Borcea-Fetești
6921	MiG-21UM	516903021	6 to 7-1973	RdeV 57	Believed scrapped
6926	MiG-21UM	516903026	6 to 7-1973		Noted 26-6-2007 stored at Aerostar facility, Craiova
6946	MiG-21UM	516907046	1973	RdeV 86	Crashed 20-4-1989
6951	MiG-21UM	516907051	1973	RdeV 93	Not noted since 1991, believed scrapped
6956	MiG-21UM	516907056	1973		Noted 2006 stored at Aerostar
6961	MiG-21UM	516907061	1973		Noted 2006 stored at Aerostar
9501 Black	MiG-21UM	516941016	7-1975		**Lancer B**, 'Forțele Aeriene Române' titles. BdeV 95, noted 2006 Bacău
9506	MiG-21UM	516953006?	1976		BdeV 86
9511	MiG-21UM	516953011?	1976		**Lancer B**, BdeV 95, crashed 17-8-1999
9516	MiG-21UM	516953016	1976		**Lancer B**, BdeV 93, BdeV 95, noted active 26-6-2007 Bacău, 202 EdeV
9521	MiG-21UM	516953021	1976		BdeV 91, crashed 27-7-1995
9526 White	MiG-21UM	516953026	1976		**Lancer B**, two-tone blue camouflage with 'Romanian Air Force/861 Fighter Squadron' titles. Later repainted in standard green/brown camouflage as 9526 Black but with white undersides, wing/tail unit leading edges, nose and rudder, 'Forțele Aeriene Române' titles. BdeV 86, noted 276-6-2007 Borcea-Fetești
9531	MiG-21UM	516953031	1976	RdeV 91	Crashed 30-9-1977
9536 Black	MiG-21UM	516953036	1976		**Lancer B**, BdeV 86, BdeV 95, noted active 26-6-2007 Bacău
9541	MiG-21UM	516953041	1976		**Lancer B**, BdeV 93, BdeV 95, noted active Câmpia Turzii 25-6-2007, BdeV 71
9566	MiG-21UM	516953066?	1976	RdeV 86	Crashed 4-1992

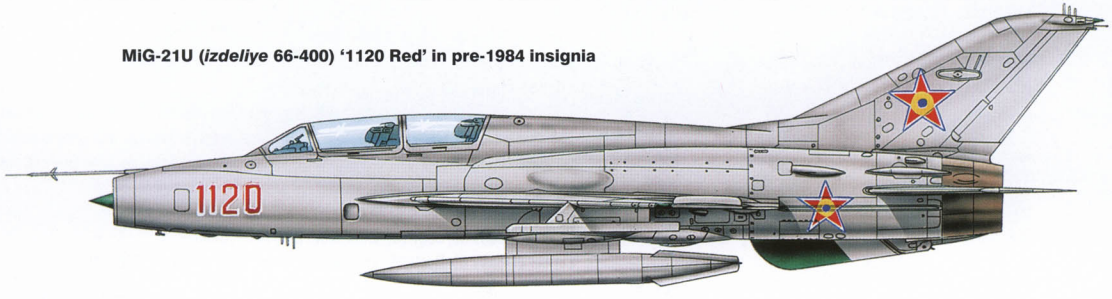
MiG-21MF Lancer A '904 Black', EdeV 862, Borcea-Fetești AB, 2006

MiG-21MF Lancer C '6824 Black', EdeV 861, Borcea-Fetești AB, 2006

▶ **MiG-21U '1120 Red' in the original overall silver finish. It was later painted grey.**

Yefim Gordon archive

MiG-21U (*izdeliye* 66-400) '1120 Red' in pre-1984 insignia



renamed **Slovak Air Force** (*Vzdušné Sily armády Slovenskej Republiky*) in 1999. At the time of the split the aircraft of the Czechoslovak Air Force were divided 2:1 in the favour of the Czech Republic. However, allowances were made for horse trading; for example, Slovakia did not take any MiG-23s but received a greater share of MiG-21s. There were also large numbers of obsolete aircraft, such as the MiG-21PF, in storage, which were also shared out.

The MiG-21F-13 (*izdeliye* 74) had been licence-built by the Aero Vodochody National Corporation as the S-106, and 21 of these aircraft were put into storage in Slovakia. So were three of the surviving MiG-21PFs (*izdeliye* 76) which were allocated to Slovakia.

Carlo Kuit

▲ **Grey-painted MiG-21US '4703 Red' parked in front of a hangar at Deveselu AB.**

Chris Lofting

◀ **MiG-21UM Lancer B '9501 Black' in standard camouflage colours. Note the chaff/flare dispenser.**

Guido Buehlmann

◀ **Another Lancer B, '9526 White', received this blue colour scheme for an airshow performance in August 2001.**

Slovakia received 11 MiG-21PFM (*izdeliye* 94) fighters (see page 663).

Eight MiG-21R reconnaissance aircraft (*izdeliye* 94R) joined the Slovak Air Force.

Thirteen MiG-21M fighters upgraded to MiG-21MA standard (local designation) were allocated to the Slovak Air Force. As in the Czech Air Force section, ECM denotes aircraft outfitted

via RART

◀ **Slovak Air Force MiG-21MF '8207 Black' bedecked in advertising posters at an airshow.**

Ex-CzAF MiG-21F-13s allocated to Slovakia

Serial	Version	C/n	Delivered	Comments
0005	MiG-21F-13		1-1-1993	VLU Prešov 1992 as ground instructional airframe, later Prešov Museum, Slovakia, as '0088'
0104	MiG-21F-13	460104	1-1-1993	VLU Prešov 1992 as ground instructional airframe, stored 1996 Trenčín for Military Museum Piešťany
0109	MiG-21F-13	460109	1-1-1993	VLU Prešov 1993 as ground instructional airframe, stored 1996 Trenčín for Military Museum Piešťany
0315	MiG-21F-13	560315	1-1-1993	To Slovakia 1993, now preserved Košice Technical University in bogus Slovak Air Force insignia
0412	MiG-21F-13	660412	1-1-1993	Stored 1996 Trenčín, earmarked for Military Museum Piešťany
0416	MiG-21F-13	660416	1-1-1993	Damaged and repaired at 1. SLP 9-1974, 9. SLP, 5. SLP, 1. LŠP, ferried to Vodochody 22-3-1991, stored, allocated to Slovakia and 9-6-1993 moved to Sliač, stored there and later scrapped
0420	MiG-21F-13	660420	1-1-1993	Withdrawn 22-3-1991 when moved from Přerov to Vodochody, allocated to Slovakia and 9-6-1993 transported to Sliač, Slovakia, stored there but later scrapped
0502	MiG-21F-13	660502	1-1-1993	Decommissioned 22-3-1991 and moved from Přerov to Vodochody, allocated to Slovakia, moved 9-6-1993 to Sliač, stored there and later scrapped
0515	MiG-21F-13	660515	1-1-1993	1992-93 GIA Prešov, now preserved at Košice Airport Museum, Slovakia
0516	MiG-21F-13	660516	1-1-1993	Withdrawn 27-3-1991 Přerov and ferried to Vodochody, 25-6-1993 moved to Sliač, Slovakia, stored there and later scrapped
0518	MiG-21F-13	660518	1-1-1993	Withdrawn 21-3-1991 Přerov and ferried to Vodochody, 9-6-1993 moved to Sliač, Slovakia, stored there and later scrapped
0604	MiG-21F-13	760604	1-1-1993	Ferried to Vodochody for decommissioning, allocated to Slovakia and moved to Sliač 9-6-1993, stored there and later scrapped
0605	MiG-21F-13	760605	1-1-1993	Ferried 21-3-1991 to Vodochody for decommissioning, allocated to Slovakia and moved to Sliač 9-6-1993, stored there and later scrapped
0609	MiG-21F-13	760609	1-1-1993	Withdrawn and ferried to Vodochody 21-3-1991, allocated to Slovakia and moved to Sliač 25-6-1993, stored there and later scrapped
0614	MiG-21F-13	760614	1-1-1993	Ferried from Přerov to Vodochody 27-3-1991, allocated to Slovakia 21-3-1991 and moved to Sliač 25-6-1993, stored there and later scrapped
0617	MiG-21F-13	760617	1-1-1993	Withdrawn 21-3-1991 and ferried from Přerov to Vodochody, allocated to Slovakia and moved to Sliač 9-6-1993, later scrapped
0701	MiG-21F-13	760701	1-1-1993	Decommissioned 27-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 25-6-1993, stored there and later scrapped
0710	MiG-21F-13	760710	1-1-1993	Withdrawn from use 27-3-1991 and ferried to Vodochody, allocated to Slovakia and moved to Sliač 25-6-1993, stored there, now preserved 25-6-1993 Martin Air Museum, Slovakia
0714	MiG-21F-13	760714	1-1-1993	Preserved 1992 Prešov Museum, Slovakia
0903	MiG-21F-13	960903	1-1-1993	Noted at VLU Prešov as training aid, 1993 still there, allocated to Slovakia, stored 1996 Trenčín for Military Museum Piešťany noted 2006
9904	MiG-21F-13	269904	1-1-1993	Earmarked 1973 for Syria but used instead as ground instructional airframe Prešov, allocated to Slovakia, preserved 2002 Košice Airport Museum in bogus Slovak Air Force insignia

Ex-CzAF MiG-21PFs allocated to Slovakia

Serial	Version	C/n	Delivered	Comments
0306	MiG-21PF	760306	1-1-1993	Although written off 19-5-1989 was at VLU Prešov in 1993, allocated to Slovakia, stored now Trenčín for Military Museum Piešťany. Overall silver finish
1215	MiG-21PF	761215	1-1-1993	Written off 24-5-1989, ground training airframe 1992-3 VLU Prešov, allocated to Slovakia, 10-1994 to Košice, now stored Trenčín for Military Museum Piešťany
1307	MiG-21PF	761307	1-1-1993	Written off 8-2-1990, preserved 1992 Prešov Museum, Slovakia

to carry a Type SM ECM pod under the fuselage.

The Slovak Air Force was allocated 36 MiG-21MFs (*izdeliye* 96F). This was the main version operated in the republic.

Slovakia received three MiG-21U (*izdeliye* 66-600) trainers, two MiG-21US (*izdeliye* 68A) trainers and 11 MiG-21UMs (*izdeliye* 69A). They are all listed on page 666.

On 1st January 1993 1. *Stíhací Letecký Pluk* (1. SLP, Fighter Regiment) was formed at Sliač with 2. and 4. *Stíhacia Letka* (2. and 4. SL, Fighter Squadrons) flying MiG-21MFs and MiG-21UMs. 4. SL also used the MiG-21R and MiG-21MA from 1994 until early 1995 when they were retired. 2. SL received MiG-29s in 1996 and its MiG-21s went to 4. SL, which continued with them until it was disbanded in the autumn 2001

Ex-CzAF MiG-21PFMs allocated to Slovakia				
Serial	Version	C/n	Delivered	Comments
4409	MiG-21PFM (*izd.* 94A)	94A4409	1-1-1993	Decommissioned Žatec 20-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 3-7-1993, stored there and later scrapped
4413	MiG-21PFM (*izd.* 94A)	94A4413	1-1-1993	Decommissioned Žatec 27-3-1991 and flown to Vodochody, allocated to Slovenia, 23-7-1993 flown to Sliač, stored there and later scrapped
4414	MiG-21PFM (*izd.* 94A)	94A4414	1-1-1993	Allocated to Slovakia and moved to Sliač 23-7-1993, stored there and later scrapped
4415	MiG-21PFM (*izd.* 94A)	94A4415	1-1-1993	Allocated to Slovakia and moved to Sliač 23-7-1993, now preserved at Military Museum Piešťany
5410	MiG-21PFM (*izd.* 94A)	94A5410	1-1-1993	Decommissioned Žatec 20-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 3-7-1994, stored there and later scrapped
7206	MiG-21PFM (*izd.* 94A)	94A7206	1-1-1993	Decommissioned Žatec 20-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 3-7-1994, stored there and later scrapped
7207	MiG-21PFM (*izd.* 94A)	94A7207	1-1-1993	Decommissioned Žatec 20-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 3-7-1994, stored there and later scrapped
7209	MiG-21PFM (*izd.* 94A)	94A7209	1-1-1993	Decommissioned Žatec 21-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 3-7-1994, stored there and later scrapped
7908	MiG-21PFM (*izd.* 94A)	94A7908	1-1-1993	Decommissioned 27-3-1991, Brno, and ferried to Vodochody, allocated to Slovakia and moved to Sliač 5-6-1993, on 23-7-1994 stored Trenčín for Military Museum Piešťany. Overall silver finish with yellow band around the rear fuselage
7910	MiG-21PFM (*izd.* 94N)	94N7910	1-1-1993	Decommissioned Žatec 19-3-1991 and flown to Vodochody, allocated to Slovakia and moved to Sliač 3-7-1993, stored there and later scrapped
7913	MiG-21PFM (*izd.* 94N)	94N7913	1-1-1993	Decommissioned Žatec 21-3-1991, allocated to Slovakia and moved to Sliač 3-7-1994, now preserved Martin Museum, Slovakia

Slovak Air Force MiG-21Rs				
Serial	Version	C/n	Delivered	Comments
1502	MiG-21R	94R01502	1-1-1993	4-11-1992 allocated to Slovakia and ferried from 47. PZLP, Hradec Králové to Malacký-Kuchyňa, Slovakia, decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, now stored Trenčín for Military Museum Piešťany
1702	MiG-21R	94R01702	1-1-1993	4-11-1992 ferried from 47. PZLP, Hradec Králové to Malacký-Kuchyňa, Slovakia; decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, now stored Trenčín for Military Museum Piešťany
1703	MiG-21R	94R01703	1-1-1993	4-11-1992 ferried from 47. PZLP, Hradec Králové to Malacký-Kuchyňa, Slovakia; decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, now preserved Košice Museum, Slovakia. Overall silver finish
1918	MiG-21R	94R01918	1-1-1993	4-11-1992 ferried from 47. PZLP, Hradec Králové to Malacký-Kuchyňa, Slovakia; decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, now stored Trenčín for Military Museum Piešťany
1920	MiG-21R	94R01920	1-1-1993	4-11-1992 ferried from 47. PZLP, Hradec Králové to Malacký-Kuchyňa, Slovakia, decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF
1922	MiG-21R	94R01922	1-1-1993	4-11-1992 ferried from 47. PZLP, Hradec Králové to Malacký-Kuchyňa, Slovakia; decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovakian, now stored Trenčín for Military Museum Piešťany. Dark bluish green/black camouflage
1923	MiG-21R	94R01923	1-1-1993	4-11-1992 ferried from 47. PZLP, Hradec Králové to Malacký-Kuchyňa, Slovakia, decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, now preserved Košice Museum, Slovakia. Overall silver finish
1924	MiG-21R	94R01924	1-1-1993	4-11-1992 ferried from 47. PZLP, Hradec Králové to Malacký-Kuchyňa, Slovakia; decommissioned in CzAF 31-12-1992 and since 1-1-1993 Slovak AF, now stored Trenčín for Military Museum Piešťany

and its six MiG-21MFs and two MiG-21UMs moved to 2. SL.

1. SLP was redesignated 31. *Stíhacie Letecké Křídlo* (Fighter Wing) in early 1995 but changed again to 1. *Letecká Základna* (1. LZ, Aviation Base) in the autumn of 2001 and later still that year to 1. SLK.

Kuchyňa-Malacký AB from 1st January 1993 housed the 3. *Stíhací-Bombardovací Letecký Pluk* (3. SBoLP, 3rd Fighter-Bomber Regiment). It comprised two squadrons using MiG-21MAs, 'MFs, 'Rs and 'UMs until the MiG-21Rs and MiG-21MAs were transferred to Sliač in 1994. 3. SBoL (*Stíhací-Bombardovací*

Slovak Air Force MiG-21MAs				
Serial	**Version**	**C/n**	**Delivered**	**Comments**
1112	MiG-21MA	961112	1-1-1993	Allocated to Slovakia and flown to Malacký-Kuchyňa 21-11-1992 to join the Slovak Air Force on 1-1-1993, noted 2006 stored Piešťany
1113	MiG-21MA	961113	1-1-1993	Allocated to Slovakia and flown to Malacký-Kuchyňa 21-11-1992 to join the Slovak Air Force on 1-1-1993, noted 2006 stored Piešťany
1114	MiG-21MA	961114	1-1-1993	Allocated to Slovakia and flown to Malacký-Kuchyňa 21-11-1992 to join the Slovak Air Force on 1-1-1993, noted 2006 stored Sliač
1201	MiG-21MA	961201	1-1-1993	Allocated to Slovakia and joined the Slovak Air Force on 1-1-1993, noted 2006 stored Sliač
1203	MiG-21MA	961203	1-1-1993	Allocated to Slovakia and flown to Malacký-Kuchyňa 21-11-1992 to join the Slovak Air Force on 1-1-1993, noted 2006 stored Sliač
1206	MiG-21MA	961206	1-1-1993	**ECM**, allocated to Slovakia and flown to Malacký-Kuchyňa 21-11-1992 to join the Slovak Air Force on 1-1-1993, noted stored there 2001; some sources state noted 2005 preserved Ocova. Overall silver finish
1208	MiG-21MA	961208	1-1-1993	Allocated to Slovakia and flown to Malacký-Kuchyňa 20-11-1992 to join the Slovak Air Force on 1-1-1993, noted 2005 stored there
1209	MiG-21MA	961209	1-1-1993	**ECM**, allocated to Slovakia and flown to Malacký-Kuchyňa 12-11-1992 to join the Slovak Air Force on 1-1-1993, now preserved Košice Museum. Overall silver finish
1210	MiG-21MA	961210	1-1-1993	**ECM**, allocated to Slovakia and flown to Malacký-Kuchyňa 20-11-1992, then to Sliač 27-10-1992, decommissioned 21-12-1992, now preserved Košice Museum. Overall silver finish with yellow band around the aft fuselage
2615	MiG-21MA	962615	1-1-1993	Allocated to Slovakia, probably flown there 10-12/1992 to join the Slovak AF on 1-1-1993, noted 2006 stored Sliač
2705	MiG-21MA	962705	1-1-1993	Allocated to Slovakia and flown to Sliač 6-1992 to join the Slovak Air Force on 1-1-1993, noted 2003 stored Sliač, probably now scrapped
2706	MiG-21MA	962706	1-1-1993	**ECM**, allocated to Slovakia and flown to Sliač 6-1992 to join the Slovak Air Force on 1-1-1993, noted 2006 stored Sliač
2707	MiG-21MA	962707	1-1-1993	Allocated to Slovakia and flown to Sliač 23-10-1992 to join the Slovak Air Force on 1-1-1993, now preserved Košice Museum. Dark green/dark earth camouflage

Letka – Fighter-Bomber Squadron) was redesignated 4. SBoL in September 1994 and finally disbanded in 1996; five of its MiG-21MFs were put into storage at Malacký the rest going to 4. SL at Sliač. The last few MiG-21MFs and MiG-21UMs still flying were finally grounded on 1st January 2003.

Somalia

Created in 1960 from former British and Italian colonies, the new republic of Somalia formed the **Somalia Aeronautical Corps** (SAC, or *Dayuuradaha Xooga Dalka Somaliyeed*) in the same year. With the primary task of supporting the army, its aircraft was initially Western but from 1963 onwards, in exchange for leasing

Slovak Air Force MiG-21MFs

Serial	Version	C/n	Manufacture date	Delivered	Comments
4308	MiG-21MF	964308	19-7-71	1-1-1993	Joined the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4309	MiG-21MF	964309	23-6-71	1-1-1993	**ECM**, allocated to Slovakia and flown to Sliač 30-10-1992 to join the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4310	MiG-21MF	964310	4-7-71	1-1-1993	**ECM**, allocated to Slovakia and flown to Sliač 6-11-1992 to join the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4311	MiG-21MF	964311	25-5-71	1-1-1993	**ECM**, allocated to Slovakia and flown to Sliač 22-10-1992 to join the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4312	MiG-21MF	964312	24-6-71	1-1-1993	**ECM**, allocated to Slovakia and flown to Sliač 6-11-1992 to join the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4313	MiG-21MF	964313	24-6-71	1-1-1993	Allocated to Slovakia and flown to Sliač 22-10-1992 to join the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4401	MiG-21MF	964401	24-6-71	1-1-1993	**ECM**, allocated to Slovakia and flown to Sliač 22-10-1992 for 81. SSLT and joined the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
4402	MiG-21MF	964402	24-6-71	1-1-1993	**ECM**, allocated to Slovakia and flown to Sliač 23-10-1992 for 81. SSLT and joined the Slovak Air Force on 1-1-1993, stored Sliač where noted 2006
7702	MiG-21MF	967702	13-6-73	1-1-1993	Allocated to Slovakia from 1-1-1993, stored Sliač where noted 2006. Silver overall with 'SL' tail titles
7703	MiG-21MF	967703	14-6-72	1-1-1993	Allocated to Slovakia from 1-1-1993, stored Sliač where noted 2006.
7704	MiG-21MF	967704	11-6-72	1-1-1993	Allocated to Slovakia from 1-1-1993, stored Sliač where noted 2006
7706	MiG-21MF	967706	15-6-73	1-1-1993	Allocated to Slovakia from 1-1-1993, stored Sliač where noted 2006
7707	MiG-21MF	967707	15-6-73	1-1-1993	Allocated to Slovakia from 1-1-1993, stored Piešťany where noted 2006
7708	MiG-21MF	967708	16-6-73	1-1-1993	Allocated to Slovakia from 1-1-1993, stored Sliač until sold to Kelvin Petty, UK, who donated it as N7708 to South-West Florida Defense Antiquities Museum. Dark green/dark earth camouflage, 'Presented to the RAF Benevolent Fund International Air Tattoo by the Slovak Air Force' titles on fuselage
7710	MiG-21MF	967710	18-6-73	1-1-1993	Allocated to Slovakia from 1-1-1993, overhauled Kbely Aircraft Repair Plant then ferried 13-4-1993 to Malacký-Kuchyňa but noted stored Sliač 2006
7712	MiG-21MF	967712	18-6-73	1-1-1993	Allocated to Slovakia from 1-1-1993, noted stored Sliač 2006
7713	MiG-21MF	967713	28-6-73	1-1-1993	Allocated to Slovakia from 1-1-1993, noted stored Sliač 2004, three-tone grey camouflage, 'SL' tail titles
7714	MiG-21MF	967714	28-6-73	1-1-1993	8. SLP, to 81. SSLT Sliač 1992, allocated to Slovakia from 1-1-1993, now preserved at Košice Museum. Dark green/dark earth camouflage and 'SL' tail titles
7715	MiG-21MF	967715	28-6-73	1-1-1993	Allocated to Slovakia from 1-1-1993, noted stored Sliač 1998 but not since, possibly scrapped or sold
7801	MiG-21MF	967801	28-6-73	1-1-1993	**ECM**, allocated to Slovakia from 1-1-1993, now preserved Košice Museum. Silver overall with red/blue/white flash on fuselage, eagle's head nose art to port and '1961-2002' nose titles to starboard and 'SL' tail titles
7803	MiG-21MF	967803	5-7-73	1-1-1993	**ECM**, allocated to Slovakia from 1-1-1993, stored Sliač, noted there 2006
8205	MiG-21MF	968205	15-9-73	1-1-1993	**ECM**, allocated to Slovakia from 1-1-1993, stored Sliač, later preserved stored at Košice Museum. Dark green/dark earth camouflage and 'SL' tail titles
8207	MiG-21MF	968207	17-9-73	1-1-1993	**ECM**, allocated to Slovakia from 1-1-1993, stored Sliač noted there 2006. Dark green/dark earth camouflage
8208	MiG-21MF	968208	29-9-73	1-1-1993	Allocated to Slovakia from 1-1-1993, stored Sliač, noted there 2006. Dark green/dark earth camouflage with red/blue/white flash on fuselage
8209	MiG-21MF	968209	20-9-73	1-1-1993	Allocated to Slovakia from 1-1-1993, stored Sliač , later preserved Košice Museum. Dark green/dark earth camouflage
9404	MiG-21MF	969404	30-6-74	1-1-1993	Allocated to Slovakia from 1-1-1993, stored Sliač, later preserved Prešov Museum
9406	MiG-21MF	969406	25-6-74	1-1-1993	Allocated to Slovakia from 1-1-1993, stored Sliač, last noted there 1998
9501	MiG-21MF	969501	30-6-74	1-1-1993	**ECM**, allocated to Slovakia from 1-1-1993, stored Sliač, last noted there preserved as gate guard 2005
9502	MiG-21MF	969502	30-6-74	1-1-1993	Allocated to Slovakia from 1-1-1993, stored Sliač, now preserved Košice Museum
9710	MiG-21MF	969710	31-8-74	1-1-1993	Allocated to Slovakia from 1-1-1993, stored Sliač, probably scrapped
9712	MiG-21MF	969712	1-10-74	1-1-1993	Allocated to Slovakia from 1-1-1993, overhauled Malacký-Kuchyňa 13-4-1993, from 2005 stored Trenčín for Military Museum Piešťany. Dark green/dark earth camouflage
9713	MiG-21MF	969713	26-8-74	1-1-1993	allocated to Slovakia and flown 22-10-1992 to Sliač, Slovak AF from 1-1-1993, stored Sliač, now preserved Military Museum Piešťany. Dark green/dark earth camouflage
9714	MiG-21MF	969714	1-10-74	1-1-1993	**ECM**, decommissioned 9 to 11-1993 and stored at Plzeň-Líně, noted there 1998 but probably scrapped later or allocated to Slovak Air Force
9813	MiG-21MF	969813	20-9-74	1-1-1993	Allocated to Slovak AF from 1-1-1993, ferried to Sliač and stored there, noted 1998 but probably now scrapped
9814	MiG-21MF	969814	13-10-74	1-1-1993	Ferried to Malacký-Kuchyňa 6-11-1992, allocated to Slovak AF from 1-1-1993, now pres. Prešov Museum
9815	MiG-21MF	969815	8-10-74	1-1-1993	Allocated to Slovak AF from 1-1-1993 and ferried Sliač, where stored, noted 1997 but probably now scrapped

bases at three ports, the USSR supplied much of the military equipment. In 1974 the the SAC took delivery of the first ten MiG-21MF (*izdeliye* 96F) fighters and four MiG-21UM (*izdeliye* 69A) trainers. It is not certain how many ultimately arrived but most sources suggest a maximum of 45 fighters and ten trainers.

Together with MiG-15s, MiG-17s and Shenyang F-6s they went into action in 1977 when the Ogaden region of Ethiopia was invaded by Somalian troops. The war ended disastrously for Somalia in 1978, and in the series of civil wars that followed the MiG-21s, together with the rest of the SAC aircraft, were

Slovak Air Force MiG-21U trainers

Serial	Version	C/n	Delivery	Comments
2419	MiG-21U (*izd.* 66-600)	662419	1-1-1991	20-3-1991 ferried to Vodochody for storage, allocated to Slovak AF from 1-1-1993 and ferried Sliač 20-9-1993 and decommissioned, then stored, later preserved and stored Trenčín for Military Museum Piešťany
2916	MiG-21U (*izd.* 66-600)	662916	1-1-1991	Decommissioned 20-3-1991 and ferried to Vodochody, allocated to Slovak AF from 1-1-1993, engine changed 22-7-1993 at Kbely Aircraft Repair Plant and ferried Sliač 13-6-1994 where stored, now preserved and stored for Martin Museum. Overall silver finish
4820	MiG-21U (*izd.* 66-600)	664820	1-1-1991	Decommissioned 17-7-1990 at 1. LŠP Přerov, allocated to Slovak AF from 1-1-1993, now reported to be preserved at Burton Station, Ohio, USA where noted 2004

Slovak Air Force MiG-21USs

Serial	Version	C/n	Delivery	Comments
0441	MiG-21US	04685141	1-1-1991	Moved to 81. SSLT Sliač 5-1991, allocated to Slovak AF from 1-1-1993, stored Sliač, now preserved and stored Trenčín for Military Museum Piešťany
0646	MiG-21US	06685146	1-1-1991	Allocated to Slovak AF from 1-1-1993, stored Sliač, now preserved and stored Trenčín for Military Museum Piešťany

Slovak Air Force MiG-21UMs

Serial	Version	C/n	Manufacture date	Delivered	Comments
0268	MiG-21UM	02695168	10-8-72	1-11-1993	6-11-1992 moved to Malacký-Kuchyňa, allocated to Slovak AF from 1-1-1993, now preserved Košice Museum
0368	MiG-21UM	03695168	15-8-72?	1-11-1993	6-11-1992 moved to Malacký-Kuchyňa, allocated to Slovak AF from 1-1-1993, stored Sliač, noted there 2006
0475	MiG-21UM	04695175	29-5-73	1-11-1993	8. SLP, to 81. SSLT, Sliač 5-1991, allocated to Slovak AF from 1-1-1993, 81. SSLT, stored Sliač, now preserved Košice Museum. Dark green/dark earth camouflage
3041	MiG-21UM	516913041	22-2-74	1-11-1993	1-1992 moved to Malacký-Kuchyňa, allocated to Slovak AF from 1-1-1993, now preserved and stored Trenčín for Military Museum Piešťany
3051	MiG-21UM	516913051	28-2-74	22-4-1974	First Unit 9. SLP. Moved to Malacký-Kuchyňa, allocated to Slovak AF from 1-1-1993, decommissioned 1994 and stored at Plzeň-Líně until sold as N21UT to Experimental Rocket Racing Association, Bothell, WA, USA
3156	MiG-21UM	516931056	28-2-75	1-11-1993	19-11-1992 moved to Malacký-Kuchyňa, allocated to Slovak AF from 1-1-1993, now preserved and stored Trenčín for Military Museum Piešťany
3176	MiG-21UM	516931076	18-2-75	1-11-1993	6-11-1992 moved to Malacký-Kuchyňa, allocated to Slovak AF from 1-1-1993, stored Sliač , still there 2001
3741	MiG-21UM	516937041	4-5-75	1-11-1993	81. SSLT Sliač from 1982 onwards, allocated to Slovak AF from 1-1-1993, 81. SSLT, stored Sliač , still there 2001. Silver overall, 'SL' tail titles
5026	MiG-21UM	516905026	17-9-73?	1-11-1993	although allocated to Slovak AF from 1-1-1993 underwent overhaul at Kbely Aircraft Repair Plant until 26-8-1993 when ferried to Slovakia, now preserved and stored Trenčín for Military Museum Piešťany. Dark green/dark earth camouflage, 'SL' tail titles
5101	MiG-21UM	516923001	30-8-74	1-11-1993	Allocated to Slovak AF from 1-1-1993, 81. SSLT, stored Sliač, still there 2006
5166	MiG-21UM	516921066	28-8-74	1-11-1993	Allocated to Slovak AF from 1-1-1993, 81. SSLT stored Sliač, now preserved and stored Trenčín for Military Museum Piešťany

All photos via Internet

◄ MiG-21MF '8208 Black' sported a special colour scheme with a lightning bolt and wing/tailplane stripes in the Slovak national colours.

destroyed or abandoned. Eight MiG-21 wrecks were still on Mogadishu Airport's scrap dump nearly 20 years later:

Sri Lanka

Formed originally in 1951 as the Royal Ceylon Air Force, the name was changed in 1971 to **Sri Lankan Air Force** (SLAF) when the island became a Republic within the British Commonwealth. Four Chengdu F-7BS with two accompanying Guizhou FT-7Bs were delivered in 1991 and equip part of 05 Jet Squadron at Katunayake. One and possibly more F-7BS attrition replacements have been purchased. Six survivors (five fighters and one trainer) were overhauled and modernised by the Pakistan Air Force's Kamra Aircraft Repair Facility (KARF) in

◄ With a Somalian Aeritalia G.222 (M.M.60214/AM94) in the background, Somalian MiG-21MF '224' sits forlorn at Mogadishu airport in February 1993. Note the damage to the fuselage nose.

Known Somalia Aeronautical Corps MiG-21s

Serial	Version	C/n	Delivery	Comments
224	MiG-21MF	968711	1974	Later incorporated parts of cannibalised c/n 968709, noted WFU Mogadishu 1993
226	MiG-21MF	968708	1974	Later incorporated parts of cannibalised c/n 968710, noted WFU Mogadishu 1993
248	MiG-21MF	968811	1974	Later incorporated parts of cannibalised c/n 968714, noted WFU Mogadishu 1993
252	MiG-21MF	968901	1974	Noted Mogadishu Airport 1993
256	MiG-21MF	968903	1974	Noted Mogadishu Airport 1993
258	MiG-21MF	968904	1974	Noted Mogadishu Airport 1993
205	MiG-21UM	516963026	1974	Noted Mogadishu Airport 1993
208	MiG-21UM	516909001	1974	Noted Mogadishu Airport 1993

Somalia Aeronautical Corps MiG-21MF '224'
Mogadishu Airport, 1993

via Internet

via Internet

◄
Sri Lankan Air Force F-7BSs, such as CF705, were normally operated in grey colours without titles.

CTF703, a Sri Lankan Air Force FT-7B, on the flight line at Katunayake AB.
▼◄

Note: The serial CF706 was not allocated because the sum of the digits equals 13, an unlucky number; this was fairly common practice in the SLAF.

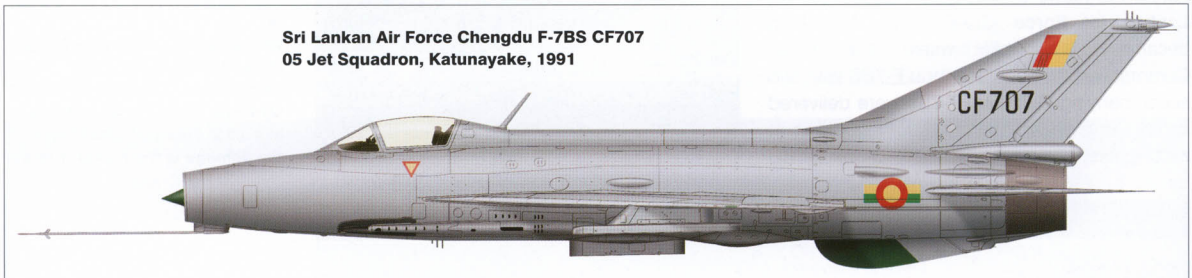
2004 and are good for another 8 years or 800 flying hours. It is understood that the intention is to continue to use them in a training role.

Sudan

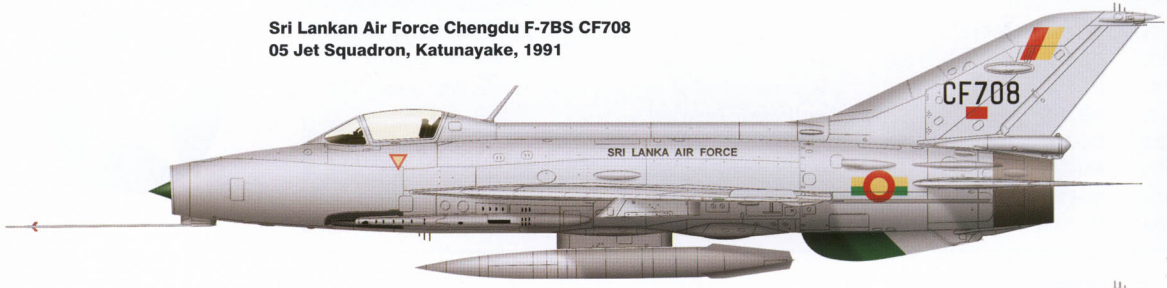
In the latter part of the 19th Century civil war broke out in the South of the Sudan where Christian and other non-Islamic people were resisting the imposition of strict Islamic Law by the Mahdi. This war was controlled, if not eliminated, after Britain and Egypt jointly accepted responsibility for the Sudan in 1896. However, shortly after Sudan became an independent republic on 1st January 1956, the civil war resumed.

The **Sudanese Air Force** (SAF, or *Silakh al Jawwiya as-Sudaniya*) was created with British

Sri Lankan Air Force Chengdu F-7BS CF707
05 Jet Squadron, Katunayake, 1991



Sri Lankan Air Force Chengdu F-7BS CF708
05 Jet Squadron, Katunayake, 1991



Sri Lankan Air Force Guizhou FT-7B CTF703
05 Jet Squadron, Katunayake, 1991

Known Sri Lankan Air Force F-7BSs/FT-7Bs						
Serial	Version	C/n	Delivered		Unit	Comments
CF704	Chengdu F-7BS	7BS 2237	1991		05 Sqn	Crashed 23-7-2000
CF705	Chengdu F-7BS	7BS 2238	1991		05 Sqn	Overhauled Kamra 2004
CF707	Chengdu F-7BS	7BS 2239	1991		05 Sqn	Overhauled Kamra 2004
CF708	Chengdu F-7BS	7BS 2240	1991		05 Sqn	Overhauled Kamra 2004
CTF703	Guizhou FT-7B	50005	1991		05 Sqn	Overhauled Kamra 2004

help in 1957 but an arms deal with the USSR signed in 1968 led to the delivery of 18 MiG-21PFs (*izdeliye* 76) and two MiG-21Us (*izdeliye* 66-600) in 1970. They were operated by No. 2 Sqn at Wadi Sayyidna.

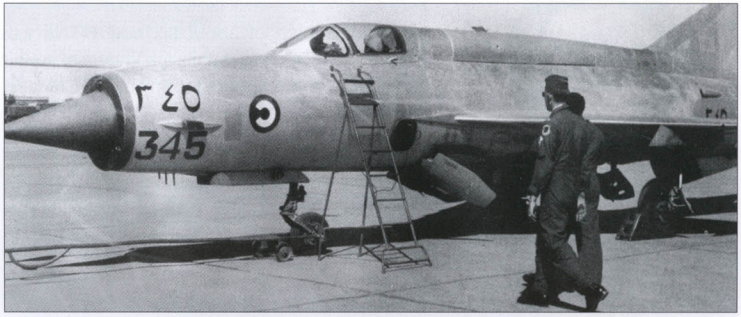
Eighteen MiG-21M (*izdeliye* 96) fighters and four MiG-21US (*izdeliye* 68A) or MiG-21UM (*izdeliye* 69A) trainers were delivered in 1971. The trainers were reported with spurious construction numbers not fitting any known system.

The number of these aircraft had reduced to seven and two respectively by 1992, with only about half of these totals operational. From 1988 they were steadily replaced in 2 Sqn by MiG-23s, a process completed by the arrival of MiG-29SEs in July 2004. None are in service today.

The USSR fell out of favour with the Sudanese government and China stepped into the breach in 1987 by supplying 15 Chengdu F-7B fighters (another source says nine in 1987 and six in 1995), plus two Guizhou FT-7 trainers. Further supplies came from Iran in 1997 when 22 Chengdu F-7Ns were reportedly delivered.

'345', one of the Sudanese Air Force's MiG-21Ms.
▼

Sudanese Air Force MiG-21US '303' hangared at Wadi Sayyidna.
▼▼



All photos via Internet

Sudanese Air Force MiG-21M '344'
No. 2 Sqn, Wadi Sayyidna

Sudanese Air Force MiG-21M '345'
No. 2 Sqn, Wadi Sayyidna

All photos via Internet

▲ **Sudanese Air Force MiG-21M '344' taxiing at Wadi Sayyidna.**

A final batch of about six new F-7Ns was delivered in 1998. No details are known of serials or construction numbers for any of the Chinese-built aircraft.

Known Sudanese Air Force MiG-21Ms and MiG-21USs

Serial	Version	C/n	Delivery	Comments
344	MiG-21M	?	1971	Silver overall
345	MiG-21M	?	1971	Silver overall
221	MiG-21US	516806208?	1971	Renumbered 301
222	MiG-21US	516806209?	1971	Renumbered 302
223	MiG-21US	516806210?	1971	Renumbered 303, silver overall
224	MiG-21US	516806211?	1971	Renumbered 304

Sudanese AF MiG-21PFs and MiG-21Us

Serial	Version	C/n	Delivery
201	MiG-21PF	7607401	1970
202	MiG-21PF	7607402	1970
203	MiG-21PF	7607403	1970
204	MiG-21PF	7607404	1970
205	MiG-21PF	7607405	1970
206	MiG-21PF	7607406	1970
207	MiG-21PF	7607407	1970
208	MiG-21PF	7607408	1970
209*	MiG-21PF	7607409	1970
210	MiG-21PF	7607410	1970
211	MiG-21PF	7607411	1970
212	MiG-21PF	7607412	1970
213	MiG-21PF	7607413	1970
214	MiG-21PF	7607414	1970
215*	MiG-21PF	7607415	1970
216	MiG-21PF	7607416	1970
217	MiG-21PF	7607417	1970
218	MiG-21PF	7607418	1970
219	MiG-21U (*izd.* 66-600)	?	1970
220	MiG-21U (*izd.* 66-600)	?	1970

*Crashed

By 2007 only 28 F-7 variants were still in service, 12 F-7s with 1st Fighter Squadron and the remainder were in storage, having been replaced in 2nd Fighter Squadron by MiG-29s.

12 second-hand MiG-21s from the Ukraine were to be delivered in 2007. Apparently the Eastern European mercenaries employed by the Sudanese government preferred Russian-built aircraft, hence the order!

Syria

The **Syrian Arab Air Force** (*al Quwwat al-Jawwiya al-Arabiya as-Souriya*) was established in the early 1950s and its first MiG-21F-13 (*izdeliye* 74) fighters arrived around 1962-63. Between 1958 and 1961 Syria was, with Egypt, a constituent of the United Arab Republic (UAR) but their ways were now diverging, leaving as their only common cause a shared enmity with Israel. The first of 40 or 45 MiG-21F-13s was delivered to Syria in 1965 and they were to equip three squadrons – Nos 8, 10 and 11. Serials starting with 1301 were applied. Even before the start of the Six-Day War six MiG-21F-13s were lost (presumably mostly this type) on 7th April 1967 in a clash with Israeli Mirage IIICJs over the Golan Heights. The Six-Day War followed a pre-emptive Israeli air strike on 5th June 1967. Syrian losses were substantial, amounting to 32 (?) MiG-21F-13s and MiG-21PFs out of a total of 60. Following this (and other wars with Israel) more MiGs were urgently supplied by the Air Forces of Iraq and Czechoslovakia (four MiG-21F-13s), Hungary (ten MiG-21F-13s) in addition to the Soviet deliveries. This further complicates the task of keeping track of individual aircraft, a task already made virtually impossible by the policy of secrecy applied by Arab governments and the USSR.

▶ **Syrian Air Force MiG-21F-13 '1864' is on display at the Army Museum in Damascus. Contrary to some reports, it is a genuine Soviet-built example, not an S-106.**

36 MiG-21PF (*izdeliye* 76) fighters arrived in 1966 and were given serials starting from 1401, but many were lost in the Six-Day War, after which in 1968, the USSR supplied a further 24.

The next version delivered to Syria was the MiG-21PFM (*izdeliye* 94A) in 1968. The first batch of 40, with serials starting 1461, was followed by a second of 60 with numbers headed by 1041.

Known Syrian Air Force MiG-21F-13s			
Serial	Version	C/n	Comments
?	MiG-21F-13	740802	Ex Polish Air Force 802, transferred 10-1973
?	MiG-21F-13	740803	Ex Polish Air Force 803, transferred 10-1973
?	MiG-21F-13	741212	Ex Hungarian Air Force 212, transferred 10-1973
?	MiG-21F-13	741214	Ex Hungarian Air Force 214, transferred 10-1973
?	MiG-21F-13	741215	Ex Hungarian Air Force 215, transferred 10-1973
?	MiG-21F-13	741216	Ex Hungarian Air Force 216, transferred 10-1973
?	MiG-21F-13	741222	Ex Hungarian Air Force 222, transferred 10-1973
?	MiG-21F-13	741302	Ex Hungarian Air Force 302, transferred 10-1973
?	MiG-21F-13	741306	Ex Hungarian Air Force 306, transferred 10-1973
?	MiG-21F-13	741311	Ex Hungarian Air Force 311, transferred 10-1973
?	MiG-21F-13	741314	Ex Hungarian Air Force 314, transferred 10-1973
?	MiG-21F-13	741320	Ex Hungarian Air Force 320, transferred 10-1973
?	MiG-21F-13	741324	Ex Hungarian Air Force 324, transferred 10-1973
?	MiG-21F-13	741810	Ex Hungarian Air Force 810, transferred 10-1973
?	MiG-21F-13	741812	Ex Hungarian Air Force 812, transferred 10-1973
?	MiG-21F-13	741906	Ex Hungarian Air Force 906, transferred 10-1973
?	MiG-21F-13	N74212007	Ex Polish Air Force 2007, transferred 10-1973
?	MiG-21F-13	N74212009	Ex Polish Air Force 2009, transferred 10-1973
?	MiG-21F-13	N74212019	Ex Polish Air Force 2019, transferred 10-1973
?	MiG-21F-13	N74212223	Ex Polish Air Force 2223, transferred 10-1973
?	MiG-21F-13 (S-106)	360002	Ex Czechoslovak Air Force 0002, transferred 1973
?	MiG-21F-13 (S-106)	360004	Ex Czechoslovak Air Force 0004, transferred 1973
?	MiG-21F-13 (S-106)	360101	Ex Czechoslovak Air Force 0101, transferred 1973
?	MiG-21F-13 (S-106)	360102	Ex Czechoslovak Air Force 0102, transferred 1973
?	MiG-21F-13 (S-106)	460106	Ex Czechoslovak Air Force 0106, transferred 1973
?	MiG-21F-13 (S-106)	560213	Ex Czechoslovak Air Force 0213, transferred 1973
?	MiG-21F-13 (S-106)	560214	Ex Czechoslovak Air Force 0214, transferred 1973
?	MiG-21F-13 (S-106)	560302	Ex Czechoslovak Air Force 0302, transferred 1973
?	MiG-21F-13 (S-106)	269901	Ex Czechoslovak Air Force 9901, transferred 1973
?	MiG-21F-13 (S-106)	269902	Ex Czechoslovak Air Force 9902, transferred 1973
?	MiG-21F-13 (S-106)	269903	Ex Czechoslovak Air Force 9903, transferred 1973
?	MiG-21F-13	N74212315	Ex Hungarian Air Force 2315, transferred 10-1973
577	MiG-21F-13	?	Noted 2001 on a dump at Aleppo
0912	MiG-21F-13 (S-106)	?	Camouflaged, early insignia
1073	MiG-21F-13	?	
1301	MiG-21F-13	?	
1864	MiG-21F-13	?	Preserved in Army Museum, Damascus
2190	MiG-21F-13	?	
2540	MiG-21F-13	?	Silver overall, early insignia
8842	MiG-21F-13	?	

▲
The original insignia of the Syrian Air Force.

Known Syrian MiG-21PFMs	
Serial	Version
1041	MiG-21PFM
1072	MiG-21PFM
1082	MiG-21PFM
1461	MiG-21PFM
1864*	MiG-21PFM
2072	MiG-21PFM
5220?	MiG-21PFM
8025	MiG-21PFS
8070	MiG-21PFS

*Preserved at Damascus War Museum

Some of these deliveries were MiG-21PFS (*izdeliye* 94A) which differed from the MiG-21PFM in having a front-hinged canopy.

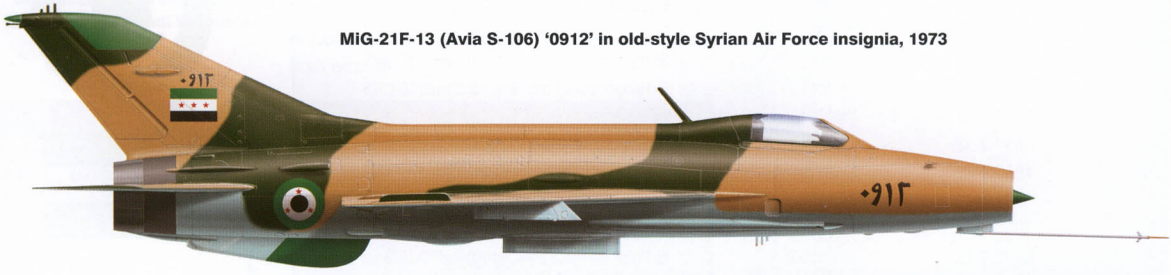
In the 1970s six MiG-21R (*izdeliye* 94RA) tactical reconnaissance aircraft were delivered; some served until at least 2000. Only one aircraft serialled 8506 has been reported but that may be misidentification (see Egyptian section).

Known Syrian Air Force MiG-21PFs		
Serial	Version	Comments
?	MiG-21PF	noted 2001 preserved as gate guard Minakh
?	MiG-21PF	noted 2001 preserved Minakh
1401	MiG-21PF	
1411	MiG-21PF	

Known Syrian MiG-21U/USs		
Serial	Version	C/n
513	MiG-21U	?
1304	MiG-21US	516801304?
1603	MiG-21US	516801603?
1702	MiG-21US	516801702?

MiG-21F-13 '2540' in old-style Syrian Air Force insignia, Six-Day War period

MiG-21F-13 (Avia S-106) '0912' in old-style Syrian Air Force insignia, 1973



▲ The current insignia of the Syrian Air Force.

Known Syrian Air Force MiG-21Ms

Serial	Version	C/n	Delivered	Comments
?	MiG-21M	962014	1973	Ex EGAF 402
?	MiG-21M	962015	1973	Ex EGAF 403
?	MiG-21M	962102	1973	Ex EGAF 407
?	MiG-21M	962105	1973	Ex EGAF 412
?	MiG-21M	962107	1973	Ex EGAF 414
?	MiG-21M	962110	1973	Ex EGAF 418
?	MiG-21M	960403	1973	Ex EGAF 532
?	MiG-21M	960710	1973	Ex EGAF 610
7501	MiG-21M	?	1973	Ex EGAF 424
7601	MiG-21M	962108	1973	Ex EGAF 415
7602	MiG-21M	962101	1973	Ex EGAF 406
7603	MiG-21M	960509	1973	Ex EGAF 582

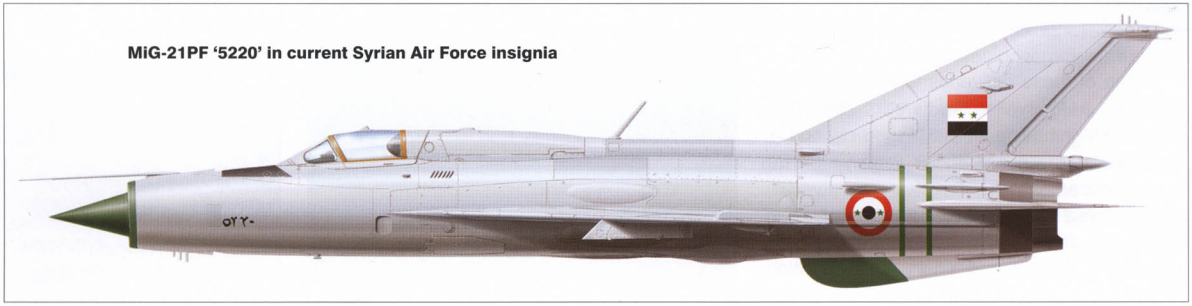
Known Syrian Air Force MiG-21MFs

Serial	Version	Comments
676	MiG-21MF	Preserved in the October Panorama Museum, Damascus
1487	MiG-21MF	
1571	MiG-21MF	
1864	MiG-21MF	Noted 2005 as active
2300	MiG-21MF	
2349	MiG-21MF	

In 1971 twenty-one MiG-21MFs (*izdeliye* 96F) were supplied to Syria, followed by 40 more in 1973. Serials allocated at first started with 1601. Such were the MiG-21 losses in the skirmishes before and during the Yom Kippur War (about 180 Syrian fighters of all types were destroyed) that the USSR supplied a further 75 MiG-21MFs in late 1973. In an effort to hide their losses, the Syrians changed the serials on their aircraft time and time again. Many new MiG-21MFs were given the serials of older destroyed fighters.

In October 1973, during the Yom Kippur War, 12 MiG-21Ms (*izdeliye* 96) were bought from East

MiG-21PF '5220' in current Syrian Air Force insignia



Germany. They were similar to the MiG-21MFs except for less powerful engines and radars.

In the Lebanon War of 1982, Syrian fighter losses are estimated by neutral observers to be 54 MiG-21s and MiG-23s. To replenish the stock and allow the withdrawal of obsolete types, in the 1980s the USSR supplied 198 MiG-21*bis* (*izdeliye* 75A) fighters that were given serials in the 1700s and 2000s.

By 1990 the inventory of the Syrian Air Force was 178 MiG-21*bis* in 12 squadrons plus 61 older variants in reserve. The MiG-21*bis* fleet was down to 172 in 1990, 160 in 1995 and 102 in 2005 (in 7 squadrons). Only two examples serialled 1074 and 1487 are known.

Little information has been released or gleaned of deliveries of the MiG-21's trainer versions to Syria. About eight MiG-21Us were delivered in the 1960s and 20 MiG-21UMs around 1973.

In 2007 it has been reported that MiG-21s still equip eight SyrAF squadrons and total about 200 aircraft, including trainers. The units are:

- 8 Squadron at Deir Zzor with MiG-21MFs;
- 12 Squadron at Tabqa with MiG-21MFs;
- 679 Squadron at Hamah with MiG-21MFs;
- 680 Squadron at Hamah with MiG-21MFs;
- 825 Squadron at Al Qusayr with MiG-21*bis*;
- 826 Squadron at Al Qusayr with MiG-21*bis*;
- 945 Squadron at Al Qusayr with MiG-21*bis*;
- 946 Squadron at Al Qusayr with MiG-21*bis*;

Tanzania

Tanzania, the former British colony, became an independent republic on 9th December 1961 and the **Tanzanian People's Defence Force Air Wing** (TPDFAW, or *Jeshi la Wananchi la Tanzania* in Swahili) was formed in September 1964.

14 MiG-21MF (*izdeliye* 96F) fighters and two MiG-21U (*izdeliye* 66) trainers were delivered from the USSR in 1974; no serials or tactical codes are known for any of them. Several were lost before the war started with Uganda in 1978. One was shot down by enemy action and another by 'friendly fire' but seven Ugandan MiG-21MFs and one MiG-21U were captured and sent to Mwanza Air Base for service in the TPDFAW. No record of the serial numbers has been found.

In 1980, ten Chengdu F-7B fighters and two Guizhou FT-7 trainers were ordered from China, followed by the arrival of two Chengdu F-7Ns from Iran in 1997. Again, no serials are known.

A further four unidentified MiG-21MFs were purchased from the Ukraine in 1998. However, by 2002 none of the MiG-21s were in use and only three or four of the Chinese-built aircraft were operational.

Uganda

In 1914 a collection of tribal homelands became the British Protectorate of Uganda. It formed an independent state in 1962 and the **Ugandan Army Air Force** was formed in 1962. Idi Amin became dictator in 1971. The first deliveries of MiG-21s took place in the early 1970s and at least 16, or even 18, MiG-21MFs (*izdeliye* 96F) and three MiG-21U variants were delivered. Seven were destroyed in the Israeli raid on Entebbe in 1976 and the rest were destroyed or

The original (1964-standard) insignia of the Ugandan Army Air Force showing the head of the crested crane, the national symbol.
▼

Ugandan Army Air Force MiG-21MF U906 with 1964-style insignia
Destroyed at Entebbe International Airport on 3rd July 1976

Ugandan Air Force MiG-21MF U-907
Destroyed at Entebbe International Airport on 3rd July 1976

All photos via Internet

▲ **An unserialled Ugandan Army Air Force MiG-21UM. Note the new-style roundels with a white centre showing the crested crane in full rather than just the head.**

▶ **This grey-painted Ugandan MiG-21*bis* is a former Polish machine overhauled by IAI in 1999.**

requisitioned as booty by the Tanzanians when their army supporting Ugandan rebels overthrew Idi Amin and captured the airport in 1979.

In 1999 six MiG-21*bis* (*izdeliye* 75A) fighters and one MiG-2UM (*izdeliye* 69A) arrived from Poland; of these, four had already been overhauled and upgraded by IAI, Israel, with the rest presumably to follow. Unlike the earlier examples, which were silver overall with yellow alphanumeric serials, these aircraft wore a grey (the single-seaters) or green/tan camouflage and red all-numeric serials. One crashed on 15th July 2003 but all the others are based at Entebbe in what is known as The Combat Unit.

USA

A surprising number of MiG-21s of various types were presented to the USAF, no doubt in the hope, if not expectation of favours in return.

Ugandan Army Air Force MiG-21s (Soviet deliveries)

Serial	Version	Comments
U-900	MiG-21U type	Exact version unknown. Wreckage noted Entebbe 1995
U-901	MiG-21U type	Exact version unknown. Wreckage noted Entebbe 1996
U-902	MiG-21U type	Exact version unknown. Wreckage noted Entebbe 1996
U-903	MiG-21MF	Destroyed in Israeli raid 3-7-1976, wreckage noted Entebbe 1995
U-904	MiG-21MF	
U-905	MiG-21MF	
U-906	MiG-21MF	Wrecked in Israeli raid 3-7-1976, wreckage noted Entebbe 2003
U-907	MiG-21MF	Destroyed in Israeli raid 3-7-1976, wreckage noted Entebbe 1999
U-908	MiG-21MF	Destroyed in Israeli raid 3-7-1976, wreckage noted Entebbe 1999
U-909	MiG-21MF	
U-910	MiG-21MF	
U-911	MiG-21MF	
U-912	MiG-21MF	
U-913	MiG-21MF	
U-914	MiG-21MF	
U-915	MiG-21MF	
U-916	MiG-21MF	Destroyed in Israeli raid 3-7-1976, wreckage noted Entebbe 1999
U-917	MiG-21MF	
U-918	MiG-21MF	
U-919	MiG-21MF	Destroyed in Israeli raid 3-7-1976, wreckage noted Entebbe 1999

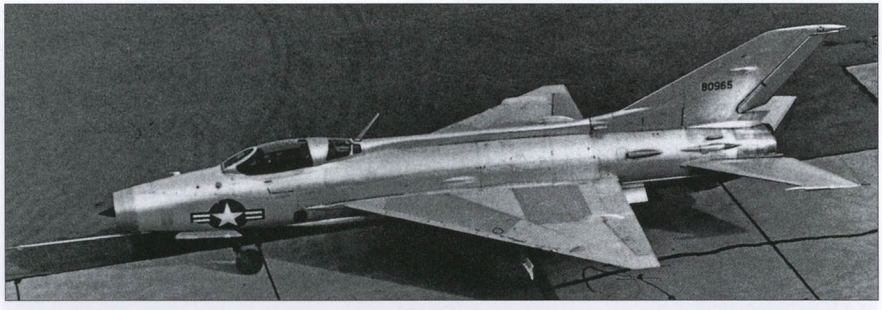
Ugandan Air Force MiG-21UM (to be serialled 9307)
Entebbe International Airport, 2007

Ugandan Army Air Force MiG-21s (Polish deliveries)				
Serial	**Version**	**C/n**	**Delivered**	**Comments**
9211 Red	MiG-21*bis*	75089211	1999	Ex Polish Air Force 9211 Red, overhauled by IAI
9307 Red (1)	MiG-21*bis*	75089307	1999	Ex Polish Air Force 9307 Red
9307 Red (2)	MiG-21UM	516999307?	?	Ex Polish Air Force 9307 Red? Noted operational in 2007
9799 Red	MiG-21*bis*	75089799	1999	Ex Polish Air Force 9799 Red
9801 Red	MiG-21*bis*	75089801	1999	Ex Polish Air Force 9801 Red
9811 Red	MiG-21*bis*	75089811	1999	Ex Polish Air Force 9811 Red, overhauled by IAI
9818 Red	MiG-21*bis*	75089818	1999	Ex Polish Air Force 9818 Red, overhauled by IAI
no serial	MiG-21UM	516999306?	1999	Overhauled IAI and delivered to Uganda; reported as ex Polish Air Force 9306 Red, but see 9307 above!

Many of these aircraft never actually operated in the USA but were broken down and examined in minute detail. The USAF put a thick veil of secrecy over the proceedings and has not officially released any information on tests carried out after 1969.

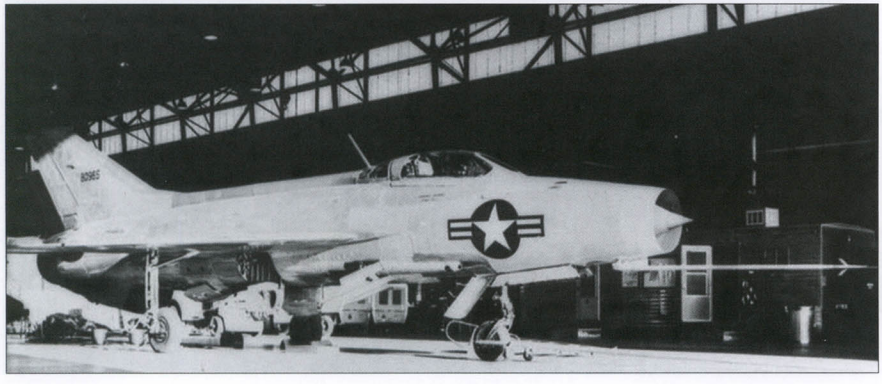
In the 1960s about a dozen MiG-21F-13 (*izdeliye* 74) fighters were presented to the USAF. The details are a closely guarded secret but it is well known from non-US sources that six Algerian Air Force MiG-21F-13 fighters landed in error at an airfield recently seized by the Israeli army in the Six-Day War while en route to join the Egyptian Air Force; they were vectored to land there by air traffic controllers, who had not been kept up to date with the Israeli advance. Four of these aircraft found their way to the USA. There is also the oft-recounted story of the Iraqi Air Force defector who landed in Israel with MiG-21F-13 '534', which was tested first by the Israeli Defence Force/Air Force as '007' and then despatched to the USA. Indonesia is reported to have sent at least 13 MiG-21F-13s (*izdeliye* 74) and one MiG-21U to the USA in the late 1960s after President Haji Mohammed Suharto switched from the USSR to the USA as his arms supplier. Twelve of the MiG-21F-13s have been noted (see table on page 678).

19 other MiG-21s have found their way to US museums and warbird collectors, particularly since the dissolution of the Warsaw Pact. The 'warbird *Fishbeds*' that flew in the USA are listed in the Appendix on privately owned MiG-21s at the end of this chapter.



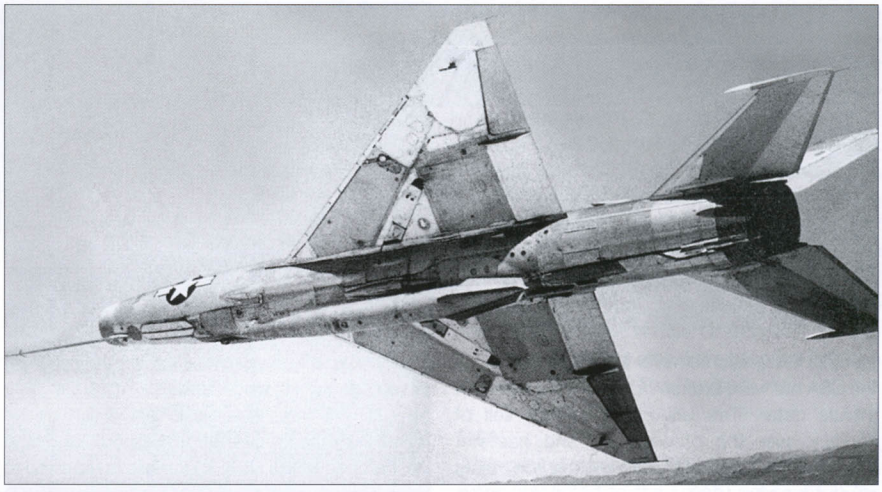
USAF

◀ **MiG-21F-13 68-0965 was evaluated by the US Air Force under the Have Doughnut programme.**



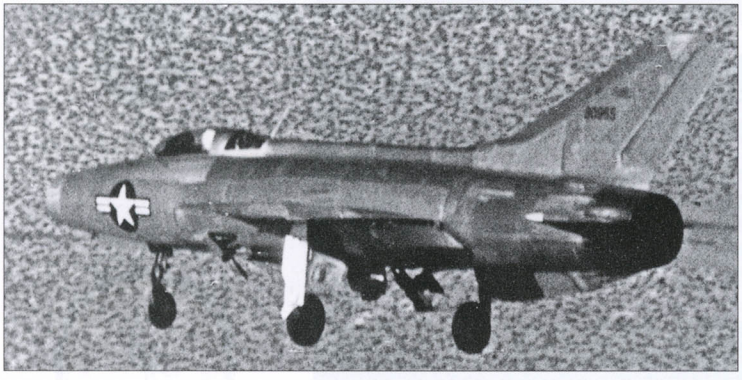
USAF

◀ **68-0965 undergoes maintenance in one of the hangars at Edwards AFB.**

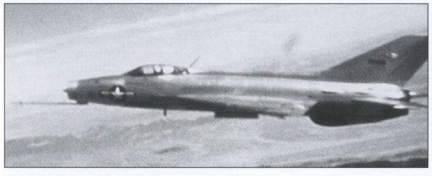


▶ **MiG-21F-13 68-0965 peels off, breaking formation with the camera ship and showing the lack of wing pylons.**

All photos USAF



▲ ▶ **More in-flight shots of the same aircraft.**



What is *not* known are the origins and history of the MiG-21F-13 that was flight-tested with the USAF serial 68-0965 under the 'Have Doughnut' programme (the use of the British spelling here is intriguing) between 23rd January and 8th April 1968. Tests took place at Groom Lake, Nevada by the Foreign Technology Division of the USAF Systems Command (AFSC), as indicated by the use of 'Have' in the project's name. A specially instrumented North American T-39 Sabreliner was used to test its vulnerability to infrared-homing missiles. The MiG was pitched against most US types, including the Boeing B-52 to determine how it could be beaten. The final report suggested it was comparable to USAF types and although lacking range and payload, was very manoeuvrable with an excellent rate of climb and acceleration making it a good interceptor. Similar words would no doubt be used on a Supermarine Spitfire tested in the 1940s. One interesting item that was singled out for praise was its 'smokeless' engine.

No doubt later variants of the MiG-21 were tested after 1969 and the speculation of the existence of an organisation called 'Red Hat' Squadron operating a wide range of Soviet built aircraft has some basis in fact; the crash of a MiG-23M on the Nellis Range on 26th April 1984 which killed Lt General Robert M. Bond could not be hidden.

US Air Force MiG-21F-13 68-0965, Air Force Systems Command

USAF

USAF

USAF

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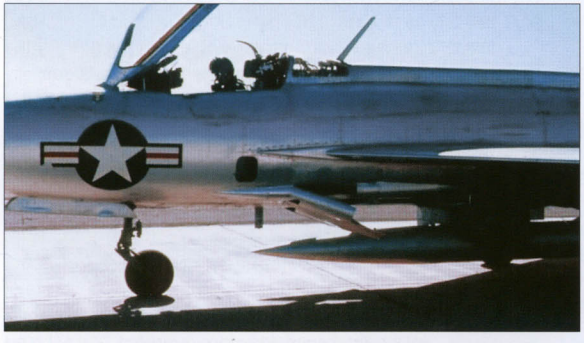
USAF



USAF

Helmut Walther

▲◄ ▲
More aspects of MiG-21F-13 68-0965 on the ground and in flight. The fighter flew together with various USAF and US Navy aircraft in the course of the evaluation, including McDonnell F-4B-14-MC Phantom II BuNo 150487 and a Vought F-8 Crusader of VX-4, NAS Point Mugu.

◄
This MiG-21F-13 painted in Soviet Air Force insignia is on display at the Smithsonian Museum's Udvar-Hazy Center.

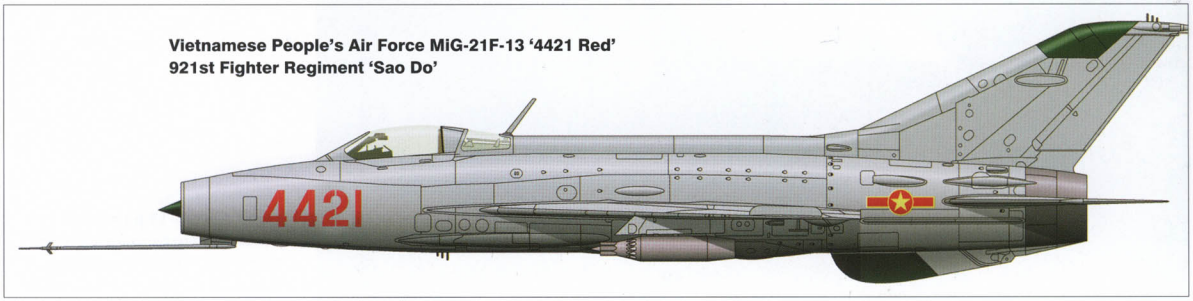
MiG-21PF N21MF converted into a radio-controlled drone by Tracor Systems Mojave, California

Indonesian Air Force MiG-21F-13s delivered to the USA

Indonesian serial	Version	C/n	Delivered to USA	Comments
F2151	MiG-21F-13	?	1968-1970	
F2152	MiG-21F-13	?	1968-1970	
F2153	MiG-21F-13	?	1968-1970	Now preseved at Nellis AFB, NV as '84'
F2155	MiG-21F-13	?	1968-1970	
F2156	MiG-21F-13	?	1968-1970	
F2157	MiG-21F-13	742107	1968-1970	Later preserved at Bruxelles Army Museum, Belgium
F2159	MiG-21F-13	?	1968-1970	
F2161	MiG-21F-13	?	1968-1970	
F2162	MiG-21F-13	?	1968-1970	
F2163	MiG-21F-13	742106	1968-1970	Now preserved at NASM, Udvar-Hazy Center, VA
F2166	MiG-21F-13	?	1968-1970	
F2170	MiG-21F-13	742116	1968-1970	
T2172	MiG-21U (izd. 66-400)	51660704	1968-1970	

Vietnam

The creation of an Air Force Research Committee on 9th March 1949 laid the foundations of the *Không Quan Nhan Dan Viêt Nam* (Vietnamese People's Army Air Force, VPAF). Its first unit, 919 Transport Regiment was created on 9th May 1949, and in 1963 the VPAF was merged with the Air Defence Forces to become *Phong Khong – Không Quan Nhan Dan Viêt Nam* (Combined Air Force and Air Defence Force). The initial fighter regiment (*Trung doan*, FR) was created on 3rd February 1964 as 921 FR 'Sao Do' having flown from China where its personnel had been in training with their MiG-17s. A second fighter regiment, 923 FR 'Yen The', was formed on 7th September 1964. By the time the first MiG-21s had arrived a war was gathering momentum between North and South Vietnam, the US forces no longer acting as advisers but fully involved militarily with some bizarre rules of engagement to placate any international opposition to their involvement. 921 FR received their first MiG-21F-13 (*izdeliye* 74) fighters in 1965 and either 20 or 30 were ultimately delivered receiving the serials 4420-29, 4520-29 and most likely 4620-29 – the last



Vietnamese People's Air Force MiG-21F-13 '4421 Red' 921st Fighter Regiment 'Sao Do'

Known Vietnamese People's Air Force MiG-21F-13s

Serial	Version	Delivered	First Unit	Comments
4420	MiG-21F-13	1965	921 FR	Preserved Nha Trang Air Base museum as '4123'
4421	MiG-21F-13	1965	921 FR	Silver overall
4422	MiG-21F-13	1965	921 FR	Silver overall
4423	MiG-21F-13	1965	921 FR	
4424	MiG-21F-13	1965	921 FR	
4425	MiG-21F-13	1965	921 FR	
4426	MiG-21F-13	1965	921 FR	
4427	MiG-21F-13	1965	921 FR	
4428	MiG-21F-13	1965	921 FR	
4429	MiG-21F-13	1965	921 FR	Silver overall
4520	MiG-21F-13	1965	921 FR	Preserved Nguyen unmarked
4521	MiG-21F-13	1965	921 FR	
4522	MiG-21F-13	1965	921 FR	
4523	MiG-21F-13	1965	921 FR	
4524	MiG-21F-13	1965	921 FR	
4525	MiG-21F-13	1965	921 FR	
4526	MiG-21F-13	1965	921 FR	
4527	MiG-21F-13	1965	921 FR	
4528	MiG-21F-13	1965	921 FR	
4529	MiG-21F-13	1965	921 FR	

Detlev Grass

◄ **Armourers prepare to hook up R-3S missiles to North Vietnamese MiG-21F-13s operated by the 921st Fighter Regiment.**

Known Vietnamese People's Air Force MiG-21PFLs

Serial	Version	Delivered	Unit	Comments
4120	MiG-21PFL	1966	921 FR	
4121	MiG-21PFL	1966	921 FR	
4122	MiG-21PFL	1966	921 FR	
4123	MiG-21PFL	1966	921 FR	
4124	MiG-21PFL	1966	921 FR	Silver overall
4125	MiG-21PFL	1966	921 FR	
4126	MiG-21PFL	1966	921 FR	
4127	MiG-21PFL	1966	921 FR	
4128	MiG-21PFL	1966	921 FR	Silver overall
4129	MiG-21PFL	1966	921 FR	
4220	MiG-21PFL	1966	921 FR	
4221	MiG-21PFL	1966	921 FR	
4222	MiG-21PFL	1966	921 FR	
4223	MiG-21PFL	1966	921 FR	
4224	MiG-21PFL	1966	921 FR	

4225	MiG-21PFL	1966	921 FR	
4226	MiG-21PFL	1966	921 FR	
4227	MiG-21PFL	1966	921 FR	Silver overall
4228	MiG-21PFL	1966	921 FR	
4229	MiG-21PFL	1966	921 FR	
4320	MiG-21PFL	1966	921 FR	
4321	MiG-21PFL	1966	921 FR	
4322	MiG-21PFL	1966	921 FR	
4323	MiG-21PFL	1966	921 FR	
4324	MiG-21PFL	1966	921 FR	C/n N76212109. Silver overall. Preserved People's Army Museum, Hanoi
4325	MiG-21PFL	1966	921 FR	
4326	MiG-21PFL	1966	921 FR	Silver overall. Preserved Air Force Museum, Hanoi
4327	MiG-21PFL	1966	921 FR	
4328	MiG-21PFL	1966	921 FR	
4329	MiG-21PFL	1966	921 FR	

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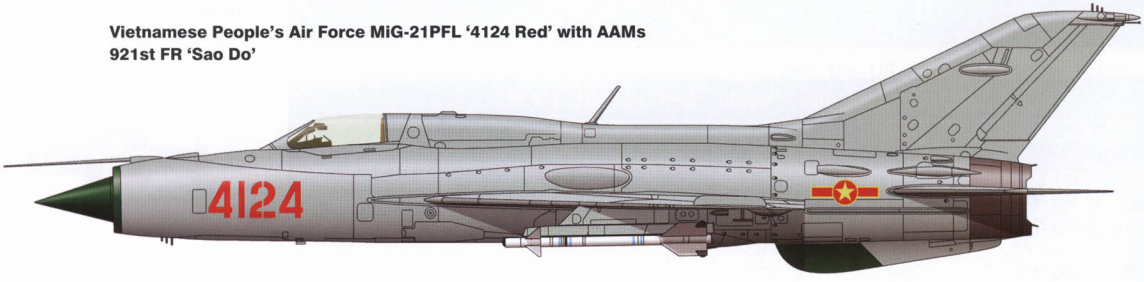
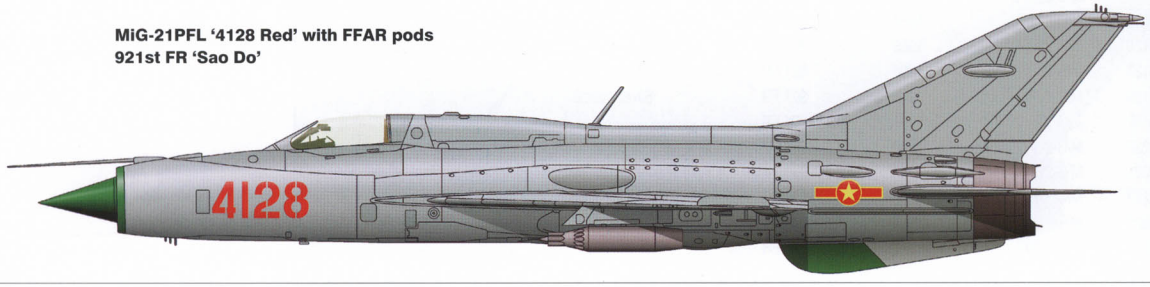
MiG-21PFL '4326 Red' wearing 13 'kill' stars is on display at the Air Force Museum in Hanoi. This is the aircraft in which ace Nguyen Van Coc shot down a US Navy F-4B-19-MC (BuNo 151485) on 7th May 1968.

Vietnamese People's Air Force MiG-21PFL '4124 Red' with AAMs
921st FR 'Sao Do'



MiG-21PFL '4128 Red' with FFAR pods
921st FR 'Sao Do'



Known Vietnamese People's Air Force MiG-21PFMs					
Serial	Version	C/n	Delivered	Unit	Comments
?	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Preserved in Army Museum Tho Xuan with fake serial '5126'
?	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Unmarked in Ho Chi Minh Museum, Hoa Binh
?	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Stored Nha Trang marked '6117'
?	MiG-21PFM (*izd.* 94A)	941418	1968-72	927 FR	Preserved Boa Tang Dong Nai as '6144'
?	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Stored Nha Trang as '6156'
5001	MiG-21PFM (*izd.* 94A)	?	1968-72		
5002	MiG-21PFM (*izd.* 94A)	?	1968-72		
5003	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Stored Nha Trang
5004	MiG-21PFM (*izd.* 94A)	?	1968-72		
5005	MiG-21PFM (*izd.* 94A)	?	1968-72		Silver overall
5006	MiG-21PFM (*izd.* 94A)	?	1968-72		Silver overall
5007	MiG-21PFM (*izd.* 94A)	?	1968-72		
5008	MiG-21PFM (*izd.* 94A)	?	1968-72		
5009	MiG-21PFM (*izd.* 94A)	?	1968-72		
5010	MiG-21PFM (*izd.* 94A)	?	1968-72		
5011	MiG-21PFM (*izd.* 94A)	?	1968-72		
5012	MiG-21PFM (*izd.* 94A)	?	1968-72		
5013	MiG-21PFM (*izd.* 94A)	?	1968-72		Silver overall
5014	MiG-21PFM (*izd.* 94A)	?	1968-72		Silver overall
5015	MiG-21PFM (*izd.* 94A)	?	1968-72	921 FR	Grey/green mottled camouflage
5016	MiG-21PFM (*izd.* 94A)	?	1968-72		
5017	MiG-21PFM (*izd.* 94A)	?	1968-72		
5018	MiG-21PFM (*izd.* 94A)	?	1968-72		
5019	MiG-21PFM (*izd.* 94A)	?	1968-72		Silver overall
5020	MiG-21PFM (*izd.* 94A)	948601	1968-72	927 FR	Silver overall. B-52 Victory Museum, Hanoi
5021	MiG-21PFM (*izd.* 94A)	?	1968-72		
5022	MiG-21PFM (*izd.* 94A)	?	1968-72		
5023	MiG-21PFM (*izd.* 94A)	?	1968-72		Silver overall
5024	MiG-21PFM (*izd.* 94A)	?	1968-72		
5025	MiG-21PFM (*izd.* 94A)	?	1968-72		Silver overall
5026	MiG-21PFM (*izd.* 94A)	?	1968-72		
5027	MiG-21PFM (*izd.* 94A)	?	1968-72		
5028	MiG-21PFM (*izd.* 94A)	?	1968-72		
5029	MiG-21PFM (*izd.* 94A)	?	1968-72		
5030	MiG-21PFM (*izd.* 94A)	?	1968-72		
5031	MiG-21PFM (*izd.* 94A)	?	1968-72		Silver overall
5032	MiG-21PFM (*izd.* 94A)	?	1968-72		
5033	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Preserved Pho Doi Can
5034	MiG-21PFM (*izd.* 94A)	?	1968-72		
5035	MiG-21PFM (*izd.* 94A)	?	1968-72		
5036	MiG-21PFM (*izd.* 94A)	?	1968-72		
5037	MiG-21PFM (*izd.* 94A)	?	1968-72		
5038	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Stored Nha Trang
5039	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Stored Nha Trang
5040	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Two-tone green camouflage
5041	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Preserved Phu Cat Base Museum
5042	MiG-21PFM (*izd.* 94A)	?	1968-72		
5043	MiG-21PFM (*izd.* 94A)	?	1968-72		
5044	MiG-21PFM (*izd.* 94A)	?	1968-72		
5045	MiG-21PFM (*izd.* 94A)	?	1968-72		
5046	MiG-21PFM (*izd.* 94A)	?	1968-72		

5047	MiG-21PFM (*izd.* 94A)	?	1968-72		
5048	MiG-21PFM (*izd.* 94A)	?	1968-72		
5049	MiG-21PFM (*izd.* 94A)	?	1968-72		
5050	MiG-21PFM (*izd.* 94A)	?	1968-72		
5051	MiG-21PFM (*izd.* 94A)	?	1968-72		
5052	MiG-21PFM (*izd.* 94A)	?	1968-72		
5053	MiG-21PFM (*izd.* 94A)	?	1968-72		
5054	MiG-21PFM (*izd.* 94A)	?	1968-72		
5055	MiG-21PFM (*izd.* 94A)	?	1968-72		
5056	MiG-21PFM (*izd.* 94A)	?	1968-72		
5057	MiG-21PFM (*izd.* 94A)	?	1968-72		
5058	MiG-21PFM (*izd.* 94A)	?	1968-72		
5059	MiG-21PFM (*izd.* 94A)	?	1968-72		
5060	MiG-21PFM (*izd.* 94A)	?	1968-72		
5061	MiG-21PFM (*izd.* 94A)	?	1968-72		
5062	MiG-21PFM (*izd.* 94A)	?	1968-72		
5063	MiG-21PFM (*izd.* 94A)	?	1968-72		Silver overall
5064	MiG-21PFM (*izd.* 94A)	?	1968-72		
5065	MiG-21PFM (*izd.* 94A)	?	1968-72		
5066	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Crude green mottle camouflage over silver
5067	MiG-21PFM (*izd.* 94A)	?	1968-72		
5068	MiG-21PFM (*izd.* 94A)	?	1968-72		
5069	MiG-21PFM (*izd.* 94A)	?	1968-72		
5070	MiG-21PFM (*izd.* 94A)	?	1968-72		
5071	MiG-21PFM (*izd.* 94A)	?	1968-72		
5072	MiG-21PFM (*izd.* 94A)	?	1968-72		
5073	MiG-21PFM (*izd.* 94A)	?	1968-72		Silver overall
5074	MiG-21PFM (*izd.* 94A)	?	1968-72		
5075	MiG-21PFM (*izd.* 94A)	?	1968-72		
5076	MiG-21PFM (*izd.* 94A)	?	1968-72		
5077	MiG-21PFM (*izd.* 94A)	?	1968-72		
5078	MiG-21PFM (*izd.* 94A)	?	1968-72		
5079	MiG-21PFM (*izd.* 94A)	?	1968-72		
6117	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Da Nang Base Museum
6120	MiG-21PFM (*izd.* 94A)	?	1968-72		
6121	MiG-21PFM (*izd.* 94A)	?	1968-72		
6122	MiG-21PFM (*izd.* 94A)	?	1968-72	927 FR	Tan/green/brown camo, Da Nang Base Museum
6123	MiG-21PFM (*izd.* 94A)	?	1968-72		
6124	MiG-21PFM (*izd.* 94A)	?	1968-72		
6125	MiG-21PFM (*izd.* 94A)	?	1968-72		
6126	MiG-21PFM (*izd.* 94A)	?	1968-72		
6127	MiG-21PFM (*izd.* 94A)	?	1968-72		
6128	MiG-21PFM (*izd.* 94A)	?	1968-72		
6129	MiG-21PFM (*izd.* 94A)	?	1968-72		
6130	MiG-21PFM (*izd.* 94A)	?	1968-72		
6131	MiG-21PFM (*izd.* 94A)	?	1968-72		
6132	MiG-21PFM (*izd.* 94A)	?	1968-72		
6133	MiG-21PFM (*izd.* 94A)	?	1968-72		
6134	MiG-21PFM (*izd.* 94A)	?	1968-72		
6135	MiG-21PFM (*izd.* 94A)	?	1968-72		
6136	MiG-21PFM (*izd.* 94A)	?	1968-72		
6137	MiG-21PFM (*izd.* 94A)	?	1968-72		
6138	MiG-21PFM (*izd.* 94A)	?	1968-72		
6139	MiG-21PFM (*izd.* 94A)	?	1968-72		
6140	MiG-21PFM (*izd.* 94A)	?	1968-72		
6141	MiG-21PFM (*izd.* 94A)	?	1968-72		

6142	MiG-21PFM (*izd.* 94A)	?	1968-72		
6143	MiG-21PFM (*izd.* 94A)	?	1968-72		
6144	MiG-21PFM (*izd.* 94A)	N94211418	1968-72		
6145	MiG-21PFM (*izd.* 94A)	?	1968-72		
6146	MiG-21PFM (*izd.* 94A)	?	1968-72		
6147	MiG-21PFM (*izd.* 94A)	?	1968-72		
6148	MiG-21PFM (*izd.* 94A)	?	1968-72		
6149	MiG-21PFM (*izd.* 94A)	?	1968-72		
6173	MiG-21PFM (*izd.* 94A)	?	1968-72		Green/brown camouflage. Preserved

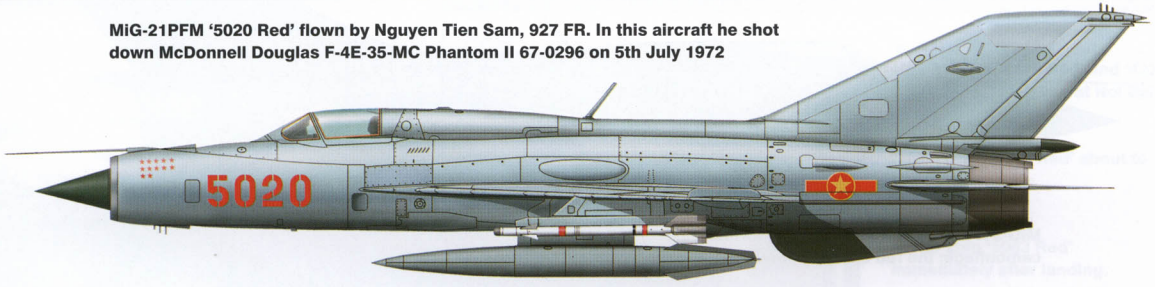
mentioned serials were delivered but the variant has not been confirmed. The 371st 'Thang Long' *Su Doan* (old name of Hanoi Air Division) was created in December 1973, incorporating not only 921 and 923 FR but also 925 and 927 FR, both of which had MiG-17s or MiG-19s.

MiG-21PFL (*izdeliye* 76) fighters built at plant No. 21 in Gor'kiy arrived in 1966 for the 921 FR and totalled 30. Some historians state the designation MiG-21PFV (V for Vietnam) but this is denied by the Mikoyan OKB. MiG-21PFL serials were 4120-29, 4220-29, 4320-29.

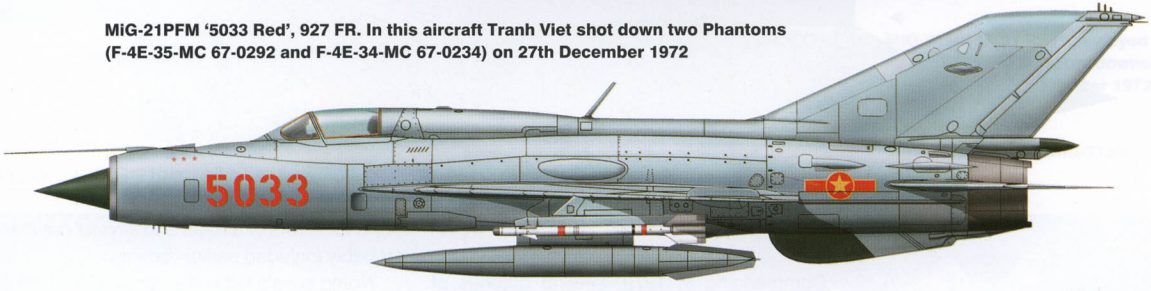
100 or 110 MiG-21PFM (*izdeliye* 94A) fighters were delivered to Vietnam primarily for the 927 FR 'Lam Son', which was formed on 3rd February 1972 as the second and only other regiment to use MiG-21s during the war. Some MiG-21PFMs had gone to 921 FR 'Sao Do' as attrition replacements in 1968. The serials were 5001-5079, 6120-6129 and 6140-6149 plus probably 6130-39.

Sixty MiG-21MFs (*izdeliye* 96F) were delivered around 1970 to re-equip the 921 FR, which became fully operational on the type at the

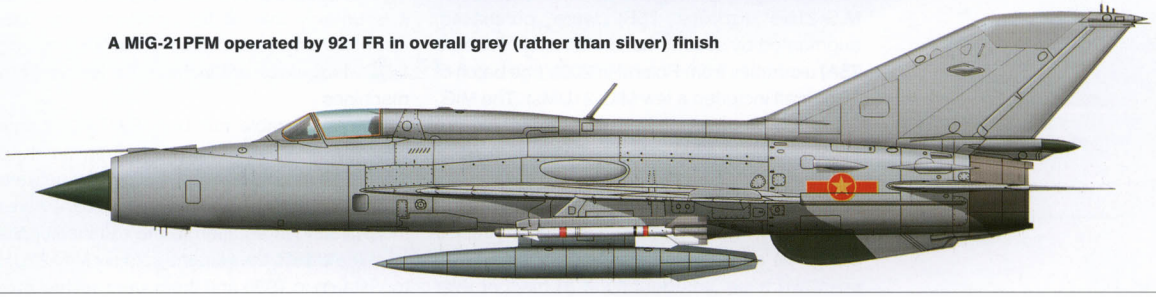
MiG-21PFM '5020 Red' flown by Nguyen Tien Sam, 927 FR. In this aircraft he shot down McDonnell Douglas F-4E-35-MC Phantom II 67-0296 on 5th July 1972



MiG-21PFM '5033 Red', 927 FR. In this aircraft Tranh Viet shot down two Phantoms (F-4E-35-MC 67-0292 and F-4E-34-MC 67-0234) on 27th December 1972



A MiG-21PFM operated by 921 FR in overall grey (rather than silver) finish



MiG-21PFM '5040 Red' flown by Le Thanh Dao, 927 FR, May 1972
5040
MiG-21PFM '5015 Red' flown by Nguyen Van Coc, 921 FR, May 1968
5015
MiG-21PFM '5066 Red', 927 FR, in makeshift camouflage
5066
MiG-21PFM '6122 Red', 927 FR, a former Soviet Air Force aircraft in Soviet camouflage; the red stars and Soviet tactical code are painted out
6122

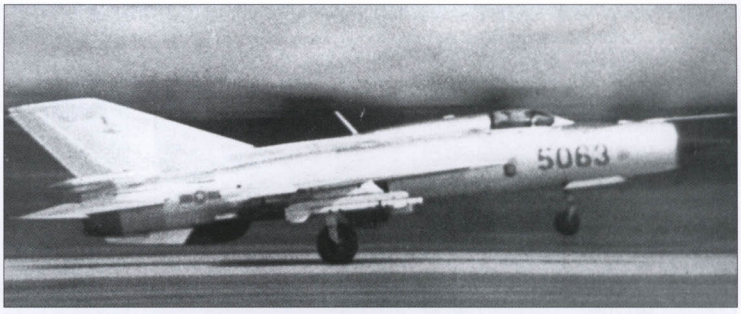
beginning of 1972. Serials used were 5100-5159.

Commencing in 1979, several batches of MiG-21*bis* (*izdeliye* 75B) were purchased, augmented by second-hand MiG-21*bis* (*izdeliye* 75A) examples from Poland in 2005 (the batch of 18 aircraft included a few MiG-21UMs). The MiG-21*bis* reportedly equipped nine regiments but not necessarily all at the same time: 920 FR at Phu Cat, 921 FR at Noi Bai, 925 FR at an unknown base, 927 FR at Kep, 929 FR at Da Nang, 931 FR at Yen Bai, 933 FR at Kien An, 935 Dong Nai at Bien Hoa and 940 FR also at an unknown base. It is doubtful if all have or ever had a full quota of aircraft and several regiments probably included earlier variants.

Noted serials fall in the range 5201-5359 but it is unlikely that all the numbers were used. Known examples are listed in the table on page 687, which does not include the former Polish machines.

A considerable number of MiG-21 trainers were utilised to service up to nine regiments and most of the trainer variants have been delivered since 1964 but MiG-21UMs (*izdeliye* 69A) were in the majority. In addition to the routine supplies from the USSR, the Ukraine sold six MiG-21UMs to Vietnam in 1996 and there were several more

via RART



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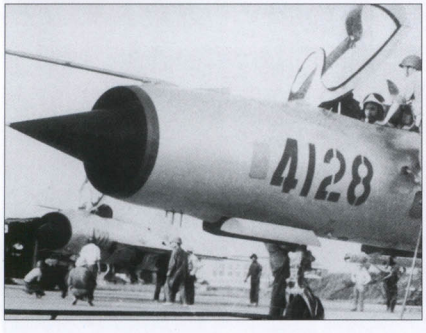


via RART

via RART

Detlev Grass

▲◄
MiG-21PFLs '4128 Red' and '4228 Red' on the flight line at Noi Bai.

▲▲
MiG-21PFL '5063 Red' about to become airborne.

▲
Sister ship '5063 Red' immediately after landing.

◄
MiG-21MF '5121 Red' displayed at the Air Force Museum downed a B-52D on 27th December 1972.

'5214 Red', a VPAF MiG-21*bis*.
▼

in the mixed bag of 18 fighters and trainers from Poland in 2005.

Although the VPAF has acquired some Sukhoi Su-27 fourth-generation fighters, a large number of MiG-21*bis*, plus a few surviving MiG-21MFs, were still in service in 2007; some reports suggest as many as 112. In the training role at least 24 MiG-21UMs were retained. Three Air Divisions and the Air Academy were still equipped with MiG-21s in 2007:

Detlev Grass

Known Vietnamese People's Air Force MiG-21MFs

Serial	Version	C/n	Unit	Comments
5100	MiG-21MF		921 FR	
5101	MiG-21MF		921 FR	
5102	MiG-21MF		921 FR	Silver overall
5103	MiG-21MF		921 FR	
5104	MiG-21MF		921 FR	
5105	MiG-21MF		921 FR	
5106	MiG-21MF		921 FR	
5107	MiG-21MF		921 FR	
5108	MiG-21MF		921 FR	
5109	MiG-21MF		921 FR	
5110	MiG-21MF		921 FR	
5111	MiG-21MF		921 FR	
5112	MiG-21MF		921 FR	
5113	MiG-21MF		921 FR	
5114	MiG-21MF		921 FR	
5115	MiG-21MF		921 FR	
5116	MiG-21MF		921 FR	
5117	MiG-21MF		921 FR	Silver overall
5118	MiG-21MF		921 FR	
5119	MiG-21MF		921 FR	
5120	MiG-21MF		921 FR	
5121	MiG-21MF	96010112	921 FR	Pres. B-52 Victory Museum, Hanoi
5122	MiG-21MF		921 FR	Silver overall
5123	MiG-21MF		921 FR	
5124	MiG-21MF		921 FR	Silver overall
5125	MiG-21MF		921 FR	
5126	MiG-21MF		921 FR	
5127	MiG-21MF		921 FR	Silver overall
5128	MiG-21MF		921 FR	
5129	MiG-21MF		921 FR	
5130	MiG-21MF		921 FR	
5131	MiG-21MF		921 FR	
5132	MiG-21MF		921 FR	
5133	MiG-21MF		921 FR	
5134	MiG-21MF		921 FR	
5135	MiG-21MF		921 FR	
5136	MiG-21MF		921 FR	
5137	MiG-21MF		921 FR	
5138	MiG-21MF		921 FR	
5139	MiG-21MF		921 FR	
5140	MiG-21MF		921 FR	
5141	MiG-21MF		921 FR	
5142	MiG-21MF		921 FR	
5143	MiG-21MF		921 FR	
5144	MiG-21MF		921 FR	Preserved Bien Hoa Air Base
5145	MiG-21MF		921 FR	
5146	MiG-21MF		921 FR	
5147	MiG-21MF		921 FR	
5148	MiG-21MF		921 FR	
5149	MiG-21MF		921 FR	Silver overall
5150	MiG-21MF		921 FR	
5151	MiG-21MF		921 FR	
5152	MiG-21MF		921 FR	
5153	MiG-21MF		921 FR	
5154	MiG-21MF		921 FR	
5155	MiG-21MF		921 FR	
5156	MiG-21MF		921 FR	
5157	MiG-21MF		921 FR	
5158	MiG-21MF		921 FR	
5159	MiG-21MF		921 FR	

via Internet

▶ **Most Vietnamese MiG-21*bis*, including '5311 Red', wear an air superiority grey finish.**

via RART

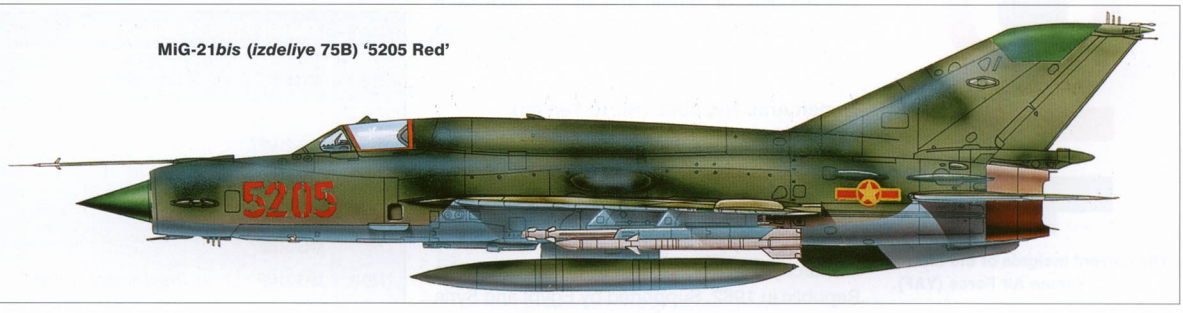
via RART

▶ **Some VPAF MiG-21*bis*, however, have a dark green/dark earth tactical camouflage; '5205 Red' is one of them.**

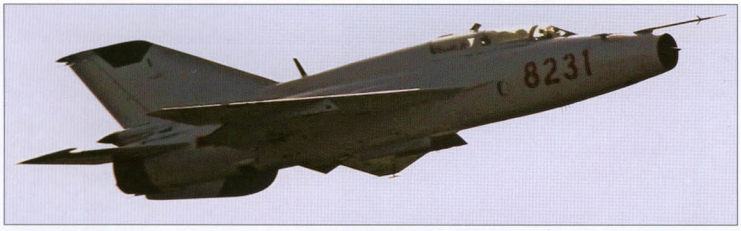
Known Vietnamese People's Air Force MiG-21*bis* fighters

Serial	Version	C/n	Unit	Comments
5201	MiG-21*bis* (*izd.* 75B?)	?	921 FR	Stored Nha Trang
5202	MiG-21*bis* (*izd.* 75B?)	?		Green/brown camouflage
5205	MiG-21*bis* (*izd.* 75B)	?		Green/brown camouflage
5209	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5210	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5211	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5212	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5214	MiG-21*bis* (*izd.* 75B)	?		Light grey overall
5217	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5221	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5222	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5229	MiG-21*bis* (*izd.* 75B?)	?	929 FR	Light grey overall
5230	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5233	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5236	MiG-21*bis* (*izd.* 75B?)	75076118	921 FR	Preserved Lenin Square, Hanoi
5237	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5249	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5279	MiG-21*bis* (*izd.* 75B?)	?	920 FR	
5284	MiG-21*bis* (*izd.* 75B?)	?		Light grey overall
5288	MiG-21*bis* (*izd.* 75B?)	?	929 FR	Light grey overall
5293	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5299	MiG-21*bis* (*izd.* 75B?)	?	931FR	
5310	MiG-21*bis* (*izd.* 75B?)	?		Stored Nha Trang
5311	MiG-21*bis* (*izd.* 75B)	?		Light grey overall
5316	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5317	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5318	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5320	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5322	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5323	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5324	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5326	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5329	MiG-21*bis* (*izd.* 75B?)	?		Light grey overall
5332	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5333	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5334	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5335	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5337	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5338	MiG-21*bis* (*izd.* 75B?)	?	929 FR	Light grey overall
5339	MiG-21*bis* (*izd.* 75B?)	?	929 FR	
5346	MiG-21*bis* (*izd.* 75B?)	?	921 FR	
5358	MiG-21*bis* (*izd.* 75B?)	?	929 FR	Light grey overall

MiG-21*bis* (*izdeliye* 75B) '5205 Red'



via Internet



Known Vietnamese People's Air Force MiG-21 trainers

Serial	Version	Unit	Comments
4124	MiG-21U (*izd.* 66-400)	921 FR	Preserved Nha Trang Base Museum
5046	MiG-21US	921 FR	Silver overall
5077	MiG-21US		Silver overall
5903	MiG-21UM	927 FR	
5905	MiG-21UM		
8104	MiG-21UM	921 FR	
8107	MiG-21UM		Preserved Nha Trang Base Museum
8202	MiG-21UM	921 FR	
8203	MiG-21UM	921 FR	
8204	MiG-21UM	921 FR	
8211	MiG-21UM	929 FR	
8212	MiG-21UM	929 FR	
8217	MiG-21UM	920 FR	Light grey overall
8219	MiG-21UM	921 FR	Light grey overall
8228	MiG-21UM	929 FR	
8231	MiG-21UM	929 FR	Light grey overall
8235	MiG-21UM	921 FR	

▲▲ **VPAF MiG-21UM '8231 Red' pictured during a low-level flypast.**

370 Air Division:
- 929 Fighter Regiment at Da Nang;
- 935 Fighter Regiment at Bien Hoa.

371 Air Division:
- 921 Fighter Regiment at Hanoi;
- 927 Fighter Regiment at Kep;
- 931 Fighter Regiment at Yen Bai.

372 Air Division:
- 933 Fighter Regiment at Kien An.

Air Academy:
- 920 Fighter Regiment at Phu Cat;
- 932 Fighter Training Regiment at Phu Cat.

▲ **The current insignia of the united Yemen Air Force (YAF).**

Yemen

The Republic of Yemen and its Air Force were created on 22nd May 1990 by the merger of two countries that up to that time had been at war:

Yemen Arab Republic (North Yemen)

The **Yemen Arab Republic Air Force** (YARAF) originated in 1957 as the Royal Yemen Air Force, and grew in size after the country joined the United Arab States in 1958. It received its present name shortly after the overthrow of the monarchy and subsequent creation of the Republic in 1962. Supported by Egypt and Syria and supplied by their ally, the USSR, the first MiG-21 fighters, variant MiG-21PF (*izdeliye* 76), were delivered in 1968 and followed by a further delivery of unknown subtype in the early 1970s. No details of these MiG-21s have survived as from 1978 YARAF began to receive aircraft from Western countries, starting with Northrop F-5Bs from Saudi Arabia. The People's Democratic Republic of Yemen (South Yemen) invaded on the 25th February 1979 but by 15th March 1979 external pressure had forced an end to the aggression. Intermittent fighting continued with the USSR supplying 45 more new MiG-21MF fighters and MiG-21UM trainers in 1979-80. At this point it is worth noting that the USSR was supplying arms and aid to both North and South Yemen and was also doing its best to unite them.

People's Democratic Republic of Yemen (South Yemen)

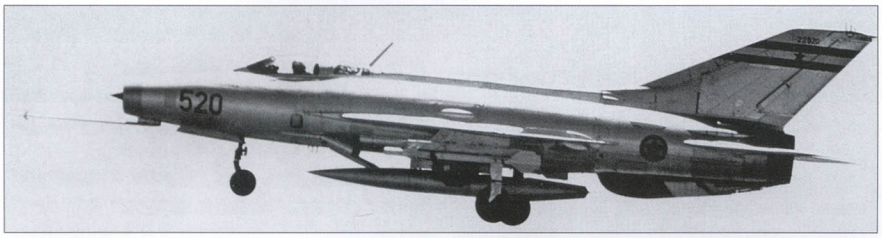
After the British pulled out of Aden and its surrounding territory in 1967 a new nation, South Yemen, was born and its Air Force created. By the end of the year this had become the **People's Democratic Republic of Yemen Air Force** (PDRYAF). In 1971 the first MiG-21F-13s (*izdeliye* 74) arrived from the USSR and, according to some sources, more were issuing from Bulgaria, Whatever the facts, sufficient numbers were acquired to form a squadron. More Soviet fighters and MiG-21 trainers arrived later in the decade and one MiG-21MF serialled 148 Black was photographed by a US Navy F-14A Tomcat in 1980. No other details are known.

The invasion of North Yemen on 25th February 1979 was militarily successful but external pressures forced a return to the starting position on 15th March 1979. A coup by a dissident faction backed by the USSR led to a civil war in which three quarters of the PDYRAF was destroyed and which resulted in economic chaos. The upshot was that on the 22nd May 1990 the two Yemeni states were united as The Republic of Yemen and the formation of a

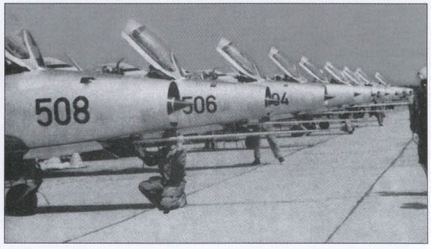
Known PDRYAF MiG-21MFs

Serial	Version	Comments
101	MiG-21MF?	
105	MiG-21MF?	
108	MiG-21MF?	
112	MiG-21MF?	
7749	MiG-21MF	noted Hodeida 12-1997

All photos via Internet



◄
22520, a missile-toting Yugoslav Air Force MiG-21F-13, with the forward airbrakes deployed.



◄
YuAF/204th LAP MiG-21F-13s on the flight line at Batajnica AB.

◄◄
The Yugoslav Air Force made use of long tunnel-like shelters where large numbers of fighters (here, MiG-21F-13s) could be concealed.

◄
22501, the first MiG-21 delivered to Yugoslavia, streams its brake parachute after landing.

The old insignia of the Yugoslav Air Force (Socialist Federal Republic of Yugoslavia).
▼

Yemen Air Force (YAF, or *al Quwwat al-Jawwiya al-Yemeniya*) comprised of the remaining aircraft of both countries.

No more details of MiG-21 survivors are available other than that the order of battle of the YAF included four squadrons totalling 47 MiG-21MFs and eight MiG-21 two-seat trainers, probably MiG-21UMs.

By 2006 it is estimated that 21 MiG-21MF were available, based at Ataq and el Hudaydah (also spelled Hodeida; No. 16 Squadron) but few would have been airworthy due to a shortage of spares . However, other reports indicate that these MiG-21 figures could be as high as 60 fighters and 12 trainers and also include some MiG-21*bis* fighters although confirmation of the last mentioned has not been obtained. These high estimates seem unlikely in view of the priority being given to MiG-29s.

There were allegedly deliveries of six Chengdu F-7M fighters in 2001 but this has not been confirmed. No deliveries were reported by China but they could have been supplied by Iran or another Islamic country.

Yugoslavia/Serbia

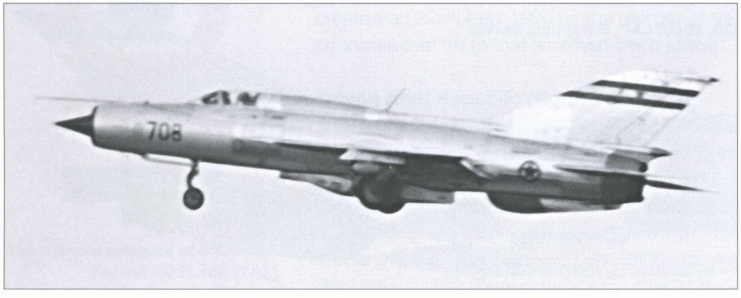
It was on 29th November 1943 on the war-torn territory of Yugoslavia that a Republic was formed with the title Socialist Federal Republic of Yugoslavia (SFRJ). The USSR, which liberated the country late in 1944 in concert with Yugoslavia's own partisan army, was friendly towards the new republic until June 1948 when relations between the governments of the two countries worsened owing to the refusal of Marshal Iosip Broz Tito, the President and Commander-in-Chief of Yugoslavia, to comply with Stalin's wishes. On 14th November 1951 a Mutual Assistance Pact was signed with the USA and the United Kingdom and the SFRJ

Yugoslav Air Force MiG-21F-13 22520, 204th LAP, Batajnica, Serbia

Yugoslav Air Force MiG-21F-13s

Serial	Version	C/n	In service date	First unit	Comments
22501	MiG-21F-13	?	9-1962	204 LAP	Noted 2005 preserved Belgrade Aviation Museum
22502	MiG-21F-13	?	9-1962	204 LAP	
22503	MiG-21F-13	?	9-1962	204 LAP	
22504	MiG-21F-13	?	9-1962	204 LAP	Noted at Time Café, Novi Sad
22505	MiG-21F-13	?	9-1962	204 LAP	
22506	MiG-21F-13	?		204 LAP	
22507	MiG-21F-13	?		204 LAP	
22508	MiG-21F-13	?		204 LAP	
22509	MiG-21F-13	?		204 LAP	
22510	MiG-21F-13	?		204 LAP	
22511	MiG-21F-13	?		204 LAP	
22512	MiG-21F-13	?		204 LAP	
22513	MiG-21F-13	?		204 LAP	
22514	MiG-21F-13	?		204 LAP	
22515	MiG-21F-13	?		204 LAP	
22516	MiG-21F-13	?		204 LAP	
22517	MiG-21F-13	?		204 LAP	
22518	MiG-21F-13	741513		204 LAP	Noted 1998 Sarajevo-Butmir airport
22519	MiG-21F-13	?		204 LAP	
22520	MiG-21F-13	?		204 LAP	
22521	MiG-21F-13	?		204 LAP	
22522	MiG-21F-13	?		204 LAP	
22523	MiG-21F-13	?		204 LAP	Noted 1998 Rajlovac, Bosnia
22524	MiG-21F-13	?		204 LAP	Noted 1998 Sarajevo-Butmir airport
22525	MiG-21F-13	?		204 LAP	
22526	MiG-21F-13	?		204 LAP	
22527	MiG-21F-13	?		204 LAP	
22528	MiG-21F-13	?		204 LAP	Noted 1998 Sarajevo-Butmir airport
22529	MiG-21F-13	?		204 LAP	
22530	MiG-21F-13	?		204 LAP	
22531	MiG-21F-13	?		204 LAP	
22532	MiG-21F-13	741702		204 LAP	Preserved Belgrade Aviation Museum
22533	MiG-21F-13	?		204 LAP	
22534	MiG-21F-13	?		204 LAP	
22535	MiG-21F-13	?		204 LAP	
22536	MiG-21F-13	?		204 LAP	Noted 1998 Rajlovac, Bosnia
22537	MiG-21F-13	?		204 LAP	
22538	MiG-21F-13	?		204 LAP	
22539	MiG-21F-13	?		204 LAP	
22540	MiG-21F-13	?		204 LAP	

Yugoslav Air Force MiG-21PFM 22708 fitted with a GP-9 cannon pod 'cleans up' after take-off. The aircraft appears to be carrying two small bombs. ▼



via IRART

increasingly relied on NATO and the USA for the supply of aid and most importantly, for aircraft. After Stalin's death in 1953, relations with the USSR slowly improved until, in 1957, it became clear that Yugoslavia favoured the Eastern Bloc for supply of aircraft. However, having learnt the fickleness of superpowers, Yugoslavia's neutral policy was continued alongside a determination to expand the indigenous aviation industry in order to avoid becoming totally dependent on either side.

The **Yugoslav Air Force and Air Defence Force** (YuAF, or JRV i PVO – *Jugoslovensko Ratno Vazduhoplovstvo i Protiv-vazdušna Odbrana*) was formed on 5th January 1945 as part of the army. These two constituent parts of the YuAF were united under a single and independent entity in July 1959. In 1986, the YuAF was organised into three Regional Corps, each containing all branches of the military; the aviation element comprised one fighter regiment and an Aviation Brigade, which contained amongst other units two fighter-bomber and one reconnaissance squadron. This conformation continued until 25th June 1991, when first Slovenia and, shortly afterwards, Croatia declared their independence. Next, Bosnia-Herzegovina and Macedonia followed suit, and a civil war ensued that was not settled until the signing of the Dayton Peace Accord in 1995. A new Federal Republic of Yugoslavia had been created on 11th April 1992 comprising the Republics of Serbia and Montenegro, and an autonomous *Ratno Vazduhoplovstvo i Protiv-vazdušna Odbrana* (RV i PVO) was formed in May/June 1992 with two specialist Corps; *Korpus protivvazdušne odbrane* (Air Defence Corps, Ko PVO) with no aircraft and the *Vazduhoplovni Korpus* (Aviation Corps, VaK). In 1994 the VaK transferred two fighter regiments of MiG-21s and MiG-29s to Ko PVO and also lost 352 *Izvidjacka Avijacijska Eskadrila* (Reconnaissance Air Squadron, IAE) *Oluj* (Storm) with its MiG-21R and MiG-21*bis* aircraft to HQ RV i PVO. Another reorganisation in 1997 occasioned the disbanding of 230 LBAE (*Lovačko-bombarderska avijacijska eskadrila*, Fighter-Bomber Squadron) with its MiG-21Ms put into storage and also 352 IAE whose MiG-21Rs, MiG-21Ms and MiG-21*bis* (reconnaissance variants) and MiG-21UMs moved to 353 IAE 'Sokolovi' (Falcons). On 27th February 2002 the General Staff took full control of all aviation, army and naval assets and abolished command HQs, such as that of the RV i PVO.

via Internet

Yugoslav Air Force MiG-21PFMs

Serial	Version	C/n	Unit	Comments
22701	MiG-21PFM	?	204 LAP*	
22702	MiG-21PFM	?	204 LAP	
22703	MiG-21PFM	?	204 LAP	
22704	MiG-21PFM	?	204 LAP	
22705	MiG-21PFM	?	204 LAP	Stored Belgrade Museum
22706	MiG-21PFM	?	204 LAP	
22707	MiG-21PFM	?	204 LAP	
22708	MiG-21PFM	?	204 LAP	GP-9 cannon pod
22709	MiG-21PFM	?	204 LAP	Noted 1998 Rajlovac, Bosnia
22710	MiG-21PFM	?	204 LAP	
22711	MiG-21PFM	?	204 LAP	
22712	MiG-21PFM	?	204 LAP	Noted 2006 preserved Ratina
22713	MiG-21PFM	?	204 LAP	
22714	MiG-21PFM	?	204 LAP	Noted 1990 stored Zagreb
22715	MiG-21PFM	?	204 LAP	
22716	MiG-21PFM	?	204 LAP	To ground instructional airframe; noted 2005 preserved Kraljevo
22717	MiG-21PFM	?	204 LAP	
22718	MiG-21PFM	?	204 LAP	
22719	MiG-21PFM	?	204 LAP	GP-9 cannon pod
22720	MiG-21PFM	?	204 LAP	
22721	MiG-21PFM	?	204 LAP	
22722	MiG-21PFM	?	204 LAP	
22723	MiG-21PFM	?	204 LAP	
22724	MiG-21PFM	?	204 LAP	
22725	MiG-21PFM	?	204 LAP	
22726	MiG-21PFM	?	204 LAP	
22727	MiG-21PFM	?	204 LAP	
22728	MiG-21PFM	?	204 LAP	
22729	MiG-21PFM	?	204 LAP	
22730	MiG-21PFM	?	204 LAP	
22731	MiG-21PFM	?	204 LAP	
22732	MiG-21PFM	?	204 LAP	
22733	MiG-21PFM	?	204 LAP	
22734	MiG-21PFM	?	204 LAP	
22735	MiG-21PFM	948407	204 LAP	Stored Belgrade Aviation Museum
22736	MiG-21PFM	?	204 LAP	

*Delivered 1968

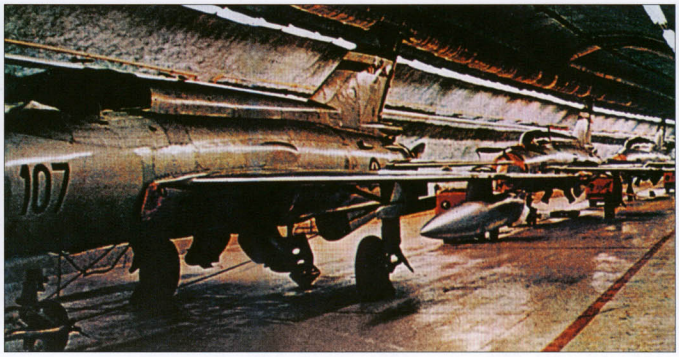
Finally, in June 2006 Montenegro, too, declared its independence and the Federal State of Yugoslavia ceased to exist; in its place two separate Republics of Serbia and Montenegro were born. From 28th February 2005 onwards the Serbian Air Force became known as *Vazduhoplovne Snage i Protiv Vazduhoplovna Odbrana Srbije* (ViPVO), Air and Defence Force of Serbia. It comprised 13 squadrons of the combined air forces under the Joint General Staff.

Throughout their existence the Yugoslav and Serbian Air Forces have been organised on a regimental basis. For example:

204 *Lovački Avijacijski Puk* (204 LAP, Fighter Regiment) in 2005 had two squadrons of MiG-21*bis*:

◄ **Three MiG-21U trainers head a flight line at Batajnica occupied mostly by MiG-21F-13s. 22902 and 22903 represent the early *izdeliye* 66-400 version, while 22913 is a broad-tailed *izdeliye* 66-600.**

via IRART



via IRART

▲ **A fine shot of MiG-21PFM 22719 equipped with a GP-9 cannon pod and two UB-16-57UM FFAR pods. In socialist times YuAF aircraft had the last three digits of the serial repeated on the nose.**

►▲ **Yugoslav Air Force MiG-21R 26107 in company with a sister ship and a two-seater in one of the storage tunnels.**

• 126 *Lovačka Avijacijska Eskadrila*, (Fighter Squadron) 'Delta' (Delta);

• 127 LAE 'Vitezovi' (Knights).

Under the current Serbian Air Force order of battle, the air regiments have been reorganised as Air Bases (*Aviacijska Baza*). The MiG-21*bis* fighters and MiG-21UM trainers of the 126 LAE have now been transferred to the 101 LAE, also based at Batajnica. No more than 20 MiG-21*bis* are in service in 2007 with 101 LAE, of which about five are airworthy, together with six or seven MiG-21UM trainers, of which two or three are supposedly operational.

Also based at Batajnica is 11 *Izvidjacko Avijacijsko Otdeljenje* (Reconnaissance Aviation Flight) which is reported to be using two MiG-21*bis* (*izdeliye* 75B) and one MiG-21M (locally known as the **L-15I**) in this role. (L stood for *Lovačko*, fighter, while the I suffix stood for *Izvidjac*, reconnaissance aircraft.)

The YuAF used five-digit serial numbers which were painted on the tailfin, the first two being a code for the aircraft type. In SFRJ days the individual last three digits were repeated on the nose; they were often removed in the civil wars and the conflict with NATO.

September 1962 saw the arrival of the first of 40 (or possibly 45) MiG-21F-13 (*izdeliye* 74) fighters which were given the local designation **L-12** with the purpose of guarding the secret of their arrival for as long as possible. They were serialled 22501-22540 and all were sent to 204 LAP at Batajnica where they stayed until the arrival of the 36 MiG-21PFMs when the new type supplanted the older, which were transferred to 117 LAP. The arrival of more modern variants meant additional transfers of the MiG-21F-13, this time to 128 LAP from which survivors were finally retired in 1980.

Having decided not to order the MiG-21PF, the YuAF first took delivery of the MiG-21PFM (*izdeliye* 94) in 1968. Given the local designation **L-14**, all 36 were allocated to the 204 LAP at Batajnica. Originally, like the MiG-21F-13s, they wore an overall silver finish; later this gave way to an overall light grey air superiority scheme. The same was true for the later MiG-21 variants and took place when Yugoslavia was still extant.

The survivors were gathered in the 129 LAE of the 185 LBAP and withdrawn from service in 1994 (see page 691).

Yugoslav Air Force MiG-21Rs

Serial	Version	C/n	Delivered	First Unit	Comments
26101	MiG-21R	?	1968 or 1969	204 LAP/126 IAE	117 LAP/352 IAE, 353 IAE (independent); reported scrapped Kraljevo
26102	MiG-21R	?	1968 or 1969	204 LAP/126 IAE	117 LAP/352 IAE, crashed 20-8-1991
26103	MiG-21R	?	1968 or 1969	204 LAP/126 IAE	117 LAP/352 IAE, 353 IAE, preserved Belgrade Aviation Museum
26104	MiG-21R	?	1968 or 1969	204 LAP/126 IAE	117 LAP/352 IAE, 353 IAE, reported scrapped Kraljevo
26105*	MiG-21R	94R1709	1968 or 1969	204 LAP/126 IAE	117 LAP/352 IAE, 353 IAE, noted 2006 stored Belgrade Aviation Museum
26106	MiG-21R	?	1968 or 1969	204 LAP/126 IAE	
26107	MiG-21R	?	1968 or 1969	204 LAP/126 IAE	117 LAP/352 IAE, 353 IAE, reported scrapped Kraljevo
26108	MiG-21R	?	1968 or 1969	204 LAP/126 IAE	117 LAP/352 IAE, 353 IAE, reported scrapped Kraljevo
26109	MiG-21R	?	1968 or 1969	204 LAP/126 IAE	117 LAP/352 IAE, crashed 8-11-1992
26110	MiG-21R	?	1968 or 1969	204 LAP/126 IAE	Written off 1-7-1985
26111	MiG-21R	?	1968 or 1969	204 LAP/126 IAE	117 LAP/352 IAE, written off 12-4-1992
26112	MiG-21R	?	1968 or 1969	204 LAP/126 IAE	117 LAP/352 IAE, defected 25-10-1991 to Austria, currently preserved Army Museum, Vienna

Yugoslav/Serbian Air Force MiG-21Ms				
Serial	**Version**	**C/n**	**Delivered**	**Comments**
22801	MiG-21M	?	1970	Reported scrapped Kraljevo
22802	MiG-21M	?	1970?	
22803	MiG-21M	?	1970?	
22804	MiG-21M	?	1970?	
22805	MiG-21M	963007	1970?	Preserved Belgrade Aviation Museum
22806	MiG-21M	?	1970?	
22807	MiG-21M	?	1970?	
22808	MiG-21M	?	1970?	
22809	MiG-21M	?	1970?	
22810	MiG-21M	?	1970?	
22811	MiG-21M	?	1970?	Reported scrapped Kraljevo
22812	MiG-21M	?	1970?	
22813*	MiG-21M	?	1970?	Noted 2005 preserved as gate guard Batajnica base
22814	MiG-21M	?	1970?	
22815	MiG-21M	?	1970?	Reported scrapped Kraljevo
22816	MiG-21M	?	1970?	Noted 2005 stored Batajnica
22817	MiG-21M	?	1970?	
22818	MiG-21M	963115	1970?	Preserved Belgrade Aviation Museum
22819	MiG-21M	?	1970?	Noted 2005 stored Batajnica
22820	MiG-21M	?	1970?	
22821	MiG-21M	?	1970?	
22822	MiG-21M	?	1970?	
22823	MiG-21M	964806?	1970?	Noted 2005 at Vazduhoplovni Opitni Centar (Aviation Test Centre, VOC)
22824*	MiG-21M	?	1970?	Remnants of old Yugoslav fin flash visible
22825	MiG-21M	?	1970?	

Yugoslav Air Force MiG-21MFs			
Serial	**Version**	**C/n**	**Delivered**
22863	MiG-21MF	?	1975
22864	MiG-21MF	?	1975?
22865	MiG-21MF	?	1975?
22866	MiG-21MF	962706?	1975?
22867	MiG-21MF	?	1975?
22868	MiG-21MF	?	1975?

via IRART

◀ **Yugoslav Air Force MiG-21M 22813 fires a ripple of unguided rockets.**

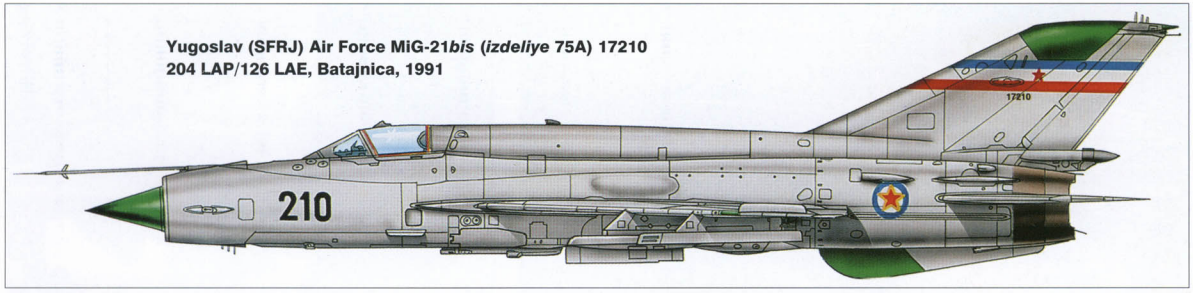
The MiG-21R (*izdeliye* 94RA) was the specialised reconnaissance variant with a local YuAF designation **L-14I**; 12 were delivered in 1968 (or 1969?) to 353 IAE at Batajnica. Survivors were withdrawn from service in December 2003, having been supplanted by MiG-21M and MiG-21*bis* fighters locally modified to carry a reconnaissance pod. Confirmed aircraft with the new-style Serbian roundels and fin flash are marked * in the tables.

The next fighter type to arrive in Yugoslavia was the MiG-21M (*izdeliye* 96), essentially an interceptor version of the MiG-21R. Designated **L-15** by the YuAF, 25 were delivered to 117 LAP and 204 LAP commencing in 1970. At least one was subsequently modified to carry a reconnaissance pod, redesignated L-15I and served with 353 IAE.

The surviving fighters were withdrawn from service in 1996 from 130 LAE of the 83 LAP.

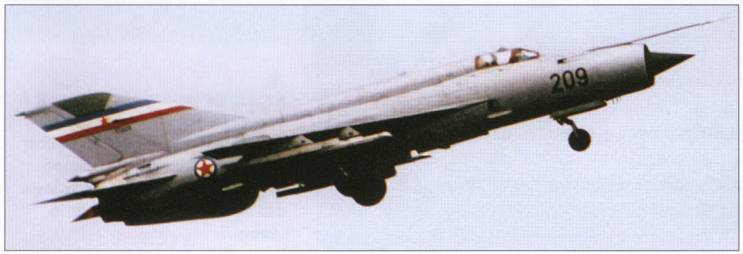
The MiG-21MF (*izdeliye* 96F) was a version of the MiG-21M with more powerful radar and engine; six were delivered in 1975 and given the local designation **L-15M**. (Some sources suggest the highest MiG-21MF serial was 22870, which makes eight aircraft.)

The final fighter variant of the MiG-21 was the MiG-21*bis*, locally designated **L-17** (*izdeliye* 75A) and **L-17K** (*izdeliye* 75B), of which between



Yugoslav (SFRJ) Air Force MiG-21*bis* (*izdeliye* 75A) 17210
204 LAP/126 LAE, Batajnica, 1991

via IRART



▲ **MiG-21*bis* (*izdeliye* 75A) 17209 takes off on a training sortie, carrying no ordnance.**

91 and 95 (different sources give different figures) were delivered from 1977. The MiG-21bis (*izdeliye* 75B) was also unofficially known as **MiG-21*bis*-K**. At least one, 17407, was converted to carry a reconnaissance pod.

Since the MiG-29s were put into storage through lack of spares the MiG-21*bis* is in 2007 the primary fighter of the Serbian Air Force and equips 101 LAE at Batajnica.

In 1965 three MiG-21U (*izdeliye* 66-400) were delivered to the Yugoslav Air Force and designated **NL-12** (NL for *Nastavni Lovačko*, Trainer Fighter). This variant had a ventrally located parabrake and a narrow-chord vertical tail. They were taken out of service in 1991.

The next batch of trainers to arrive, 15 in all, were MiG-21U (izd. 66-600), known locally as **NL-12M**, with the larger tailfin and the parabrake under the rudder. Survivors were withdrawn from service in 1991.

The MiG-21US (*izdeliye* 68A) was the first version of the trainer to have blown flaps, seven were delivered from 1968 with local designation **NL-14**. Survivors were retired in 1991.

The roundel of the Yugoslav (Serbia & Montenegro) Air Force. ▼

via Internet

▶ **Yugoslav (Serbia & Montenegro) MiG-21*bis* (*izdeliye* 75A) fighters at Batajnica. The large digits on the nose have been removed.**

Yugoslav (Serbia & Montenegro) Air Force MiG-21*bis* (*izdeliye* 75B) 17126
204 LAP/126 LAE, Batajnica, 2005

via IRART

via IRART

▲
YuAF (Serbia & Montenegro) MiG-21M 22813 in flight.

◄
16152, a Yugoslav Air Force MiG-21UM.

Yugoslav/Serbian Air Force MiG-21*bis* fighters

Serial	Version	C/n	Line number	Delivered	Comments
17101	MiG-21*bis* (izd. 75B)	?	?	1977	
17102	MiG-21*bis* (izd. 75B)	?	?		Destroyed 13-8-1991
17103	MiG-21*bis* (izd. 75B)	?	?		Destroyed 1-5-1991
17104	MiG-21*bis* (izd. 75B)	?	?		117 LAP
17105	MiG-21*bis* (izd. 75B)	?	?		
17106	MiG-21*bis* (izd. 75B)	?	?		
17107	MiG-21*bis* (izd. 75B)	?	?		
17108	MiG-21*bis* (izd. 75B)	?	?		
17109	MiG-21*bis* (izd. 75B)	?	?		124 LAE/117 LAP, destroyed 18-9-1991
17110	MiG-21*bis* (izd. 75B)	?	?		
17111	MiG-21*bis* (izd. 75B)	?	?		
17112	MiG-21*bis* (izd. 75B)	?	?		
17120	MiG-21*bis* (izd. 75B)	?	?		
17121	MiG-21*bis* (izd. 75B)	?	?		
17125	MiG-21*bis* (izd. 75B)	?	?		
17126*	MiG-21*bis* (izd. 75B)	75049666	3122		Noted 2006 at VOC, stored Batajnica 2007
17127	MiG-21*bis* (izd. 75B)	?	?		126 LAE/204 LAP noted 2005
17128	MiG-21*bis* (izd. 75B)	?	?		
17129	MiG-21*bis* (izd. 75B)	?	?		
17130	MiG-21*bis* (izd. 75B)	?	?		Destroyed 10-1991
17131	MiG-21*bis* (izd. 75B)	?	?		
17132	MiG-21*bis* (izd. 75B)	?	1101?		126 LAE/204 LAP noted 2005, stored Batajnica 2007
17133	MiG-21*bis* (izd. 75B)	?	2119?		Defected to Croatian Air Force 4-1-1992, becoming 101
17134	MiG-21*bis* (izd. 75B)	?	?		
17135	MiG-21*bis* (izd. 75B)	?	?		
17136	MiG-21*bis* (izd. 75B)	?	?		126 LAE/204 LAP noted 2005
17151	MiG-21*bis* (izd. 75B)	?	?		
17152	MiG-21*bis* (izd. 75B)	?	?		124 LAE/117 LAP, written off 2-5-1992, on Dakovo dump 1997
17153	MiG-21*bis* (izd. 75B)	?	?		
17154	MiG-21*bis* (izd. 75B)	?	?		
17155*	MiG-21*bis* (izd. 75B)	?	?		
17156	MiG-21*bis* (izd. 75B)	?	?		126 LAE/204 LAP, destroyed 9-11-1991
17157	MiG-21*bis* (izd. 75B)	?	?		
17158	MiG-21*bis* (izd. 75B)	?	?		126 LAE/204 LAP, noted 2005 stored Batajnica
17159	MiG-21*bis* (izd. 75B)	?	?		
17160	MiG-21*bis* (izd. 75B)	?	?		
17161*	MiG-21*bis* (izd. 75B)	?	?		126 LAE/204 LAP, noted 2007 Batajnica

17162	MiG-21*bis* (izd. 75B)	?	?		126 LAE/204 LAP, noted 2005 stored Batajnica
17163	MiG-21*bis* (izd. 75B)	?	?		126 LAE/204 LAP, noted 2005 Batajnica
17164	MiG-21*bis* (izd. 75B)	?	?		
17165	MiG-21*bis* (izd. 75B)	?	?		
17166	MiG-21*bis* (izd. 75B)	?	?		Noted as wreck 2004 Ladjevci
17167	MiG-21*bis* (izd. 75B)	?	2741?		Could also be c/n 750...2741. Defected to Croatian Air Force 15-5-1992, becoming 103
17168	MiG-21*bis* (izd. 75B)	?	?		
17169	MiG-21*bis* (izd. 75B)	?	?		126 LAE/204 LAP, noted 2005 stored Batajnica
17170	MiG-21*bis* (izd. 75B)	?	?		126 LAE/204 LAP, noted 2005 stored Batajnica
17171	MiG-21*bis* (izd. 75B)	?	?		126 LAE/204 LAP, noted 2005 stored Batajnica
17201	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, noted 2005 dumped Batajnica
17202	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, noted 2005 stored Batajnica
17203	MiG-21*bis* (izd. 75A)	?	?		117 LAP, destroyed 17-9-1991
17204	MiG-21*bis* (izd. 75A)	?	?		
17205	MiG-21*bis* (izd. 75A)	?	?		Noted 2006 at VOC
17206	MiG-21*bis* (izd. 75A)	?	?		
17207	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, noted 2005 Batajnica
17208	MiG-21*bis* (izd. 75A)	?	?		Reported on dump Pristina-Slatina airport, Kosovo
17209	MiG-21*bis* (izd. 75A)	?	?		
17210	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, noted 2005 Batajnica
17211	MiG-21*bis* (izd. 75A)	?	?		
17212	MiG-21*bis* (izd. 75A)	?	?		125 LAE/204 LAP, destroyed 18-9-1991
17213*	MiG-21*bis* (izd. 75A)	?	?		
17214	MiG-21*bis* (izd. 75A)	?	?		
17215	MiG-21*bis* (izd. 75A)	?	?		
17216	MiG-21*bis* (izd. 75A)	?	?		
17217	MiG-21*bis* (izd. 75A)	?	?		
17218	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, noted 2005 stored Batajnica
17219	MiG-21*bis* (izd. 75A)	?	?		
17220*	MiG-21*bis* (izd. 75A)	?	?		
17221	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, noted 2005 Batajnica
17222*	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, noted 2005 Batajnica
17223	MiG-21*bis* (izd. 75A)	?	?		
17224*	MiG-21*bis* (izd. 75A)	?	?		
17225	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, noted 2005 dumped Batajnica
17226	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, noted 1997 Batajnica
17227	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, noted 2005 Batajnica
17228	MiG-21*bis* (izd. 75A)	?	3645?		Could also be c/n 750...3645. Destroyed by NATO 11-5-1999
17229	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, noted 2005 stored Batajnica
17230	MiG-21*bis* (izd. 75A)	?	?		125 LAE/117 LAP crashed 15-5-1989
17231	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, destroyed at Batajnica by NATO 17-5-1999
17232	MiG-21*bis* (izd. 75A)	?	?		126 LAE/204 LAP, noted 2006
17233	MiG-21*bis* (izd. 75A)	?	?		
17234	MiG-21*bis* (izd. 75A)	?	?		
17235	MiG-21*bis* (izd. 75A)	?	?		Defected to Croatian Air Force, becoming 102
17236	MiG-21*bis* (izd. 75A)	?	?		
17401	MiG-21*bis* (izd. 75B)	?	?		126 LAE/204 LAP, destroyed at Batajnica by NATO 8-5-1999
17402	MiG-21*bis* (izd. 75B)	75095222	?		War damaged 1991, stored Belgrade Aviation Museum
17403	MiG-21*bis* (izd. 75B)	?	?		
17404	MiG-21*bis* (izd. 75B)	?	?		
17405	MiG-21*bis* (izd. 75B)	75095251	?		Stored Belgrade Aviation Museum
17406	MiG-21*bis* (izd. 75B)	?	?		
17407	MiG-21*bis* (izd. 75B)	?	?		Converted for reconnaissance, noted 2005 at VOC
17408	MiG-21*bis* (izd. 75B)	?	?		
17409	MiG-21*bis* (izd. 75B)	75095293	?		Stored Belgrade Aviation Museum
17410*	MiG-21*bis* (izd. 75B)	?			

Yugoslav/Serbian Air Force MiG-21U trainers		
Serial	**Version**	**Comments**
22901	MiG-21U (*izd.* 66-400)	
22902	MiG-21U (*izd.* 66-400)	Noted 1998 dumped at Rajlovac, Bosnia
22903	MiG-21U (*izd.* 66-400)	Seen Zadar-Zemunik 8-1999; stored Belgrade Aviation Museum

Yugoslav/Serbian Air Force MiG-21U trainers (continued)			
Serial	**Version**	**C/n**	**Comments**
22904	MiG-21U (*izd.* 66-600)	?	
22905	MiG-21U (*izd.* 66-600)	?	Crashed 10-9-1979
22906	MiG-21U (*izd.* 66-600)	?	
22907	MiG-21U (*izd.* 66-600)	?	
22908	MiG-21U (*izd.* 66-600)	?	
22909	MiG-21U (*izd.* 66-600)	663416	Stored Belgrade Aviation Museum
22910	MiG-21U (*izd.* 66-600)	?	
22911	MiG-21U (*izd.* 66-600)	?	
22912	MiG-21U (*izd.* 66-600)	?	
22913	MiG-21U (*izd.* 66-600)	?	83 LAP, crashed 21-2-1985
22914	MiG-21U (*izd.* 66-600)	?	
22915	MiG-21U (*izd.* 66-600)	?	Scrapped Batajnica circa 2000
22916	MiG-21U (*izd.* 66-600)	?	
22917	MiG-21U (*izd.* 66-600)	?	
22918	MiG-21U (*izd.* 66-600)	?	Reported 1998 on Sarajevo dump

Yugoslav/Serbian Air Force MiG-21UMs			
Serial	**Version**	**C/n**	**Comments**
16151	MiG-21UM	?	Noted 2005 dumped at Batajnica
16152*	MiG-21UM	516909071	Stored Belgrade Aviation Museum
16153	MiG-21UM	?	
16154	MiG-21UM	?	126 LAE, 101 LAE, noted 2005, stored Batajnica 2007
16155*	MiG-21UM	?	126 LAE, 101 LAE, noted 2005, stored Batajnica 2007
16156	MiG-21UM	?	Scrapped Batajnica
16157	MiG-21UM	?	
16158*	MiG-21UM	516995091	Stored Belgrade Aviation Museum
16171	MiG-21UM	?	Noted Zagreb 1990
16172	MiG-21UM	?	
16173	MiG-21UM	?	
16174	MiG-21UM	516999144	126 LAE, noted 2005
16175	MiG-21UM	?	
16176	MiG-21UM	?	
16177	MiG-21UM	?	
16178	MiG-21UM	?	
16179	MiG-21UM	?	
16180*	MiG-21UM	?	126 LAE. Damaged Batajnica
16181	MiG-21UM	?	
16182	MiG-21UM	?	126 LAE, noted 2005 stored Batajnica
16183	MiG-21UM	?	
16184	MiG-21UM	?	
16185	MiG-21UM	?	Noted 2005 out of service at Batajnica
16186	MiG-21UM	?	

Yugoslav/Serbian Air Force MiG-21USs		
Serial	Version	Comments
22951	MiG-21US	
22952	MiG-21US	Scrapped Kraljevo
22953	MiG-21US	Std Belgrade Aviation Museum
22954	MiG-21US	
22955	MiG-21US	
22956	MiG-21US	Written off 1989, wreck in Croatia
22957	MiG-21US	Scrapped Kraljevo

The final trainer variant, the MiG-21UM (*izdeliye* 69), YuAF designation **NL-16**, first delivered in 1977, is still in service. In total 24 (some sources suggest 25) were purchased. To satisfy the requirements of the various Arms Control Agreements which limited the YuAF to 155 combat aircraft, eight MiG-21UMs were stripped of all armament to qualify as non-combatants.

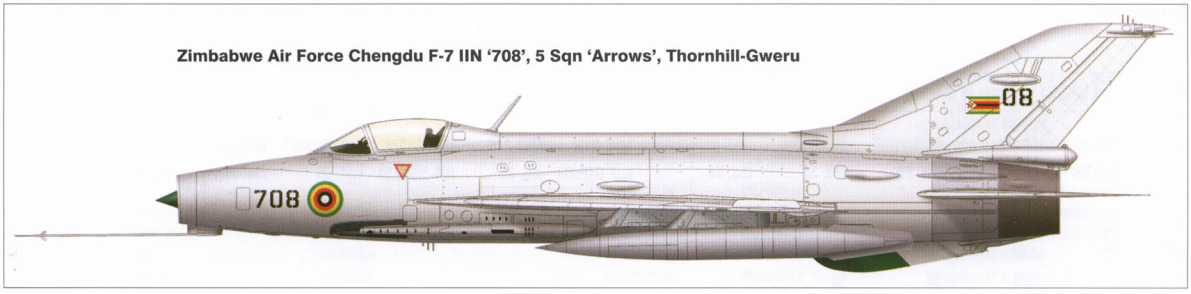
Zambia

Zambia was created in 1963 when the former British colony of Northern Rhodesia separated from the Central African Federation. The **Zambian Air Force and Air Defence Command** took delivery of 14 MiG-21bis (izd. 75A) fighters and two MiG-21UM (izd. 69) trainers in 1976. Based at first at Lusaka IAP, they later moved to Livingstone Air Base. The two trainers and the eight surviving fighters, some sources suggest 11, were sent to Israel in 1997-98 for upgrading to MiG-21-2000 standard. Some souces suggest that more than two MiG-21UMs were delivered and that five plus eight MiG-21*bis* were sent to Israel.

Zimbabwe

The **Air Force of Zimbabwe** originated as the Southern Rhodesian Air Force on 19th September 1939. It reformed after the war on 28th November 1947 becoming in 1954 the Royal Rhodesian Air Force, having federated with Nyasaland. In 1963 Nyasaland split off and renamed itself Malawi . In 1965 after a Unilateral Declaration of Independence the Royal title was

Zambian Air Force MiG-21s			
Serial	Version	Delivery	Comments
AF601	MiG-21UM	1976	Upgraded to MiG-21-2000 standard 1997-98
AF602	MiG-21UM	1976	Upgraded to MiG-21-2000 standard 1997-98
AF603	MiG-21*bis*	1976	
AF604	MiG-21*bis*	1976	
AF605	MiG-21*bis*	1976	
AF606	MiG-21*bis*	1976	
AF607	MiG-21*bis*	1976	
AF608	MiG-21*bis*	1976	
AF609	MiG-21*bis*	1976	
AF610	MiG-21*bis*	1976	
AF611	MiG-21*bis*	1976	
AF612	MiG-21*bis*	1976	
AF613	MiG-21*bis*	1976	
AF614	MiG-21*bis*	1976	
AF615	MiG-21*bis*	1976	
AF616	MiG-21*bis*	1976	



◄
A pair of Zimbabwean F-7 IINs, 704 and 707, makes a formation flypast.

◄◄
Two more F-7 IINs on the apron at Thornhill-Gweru.

◄
730, the first of two Zimbabwean FT-7BZ trainers.

All photos via Internet

removed followed in 1979 by a change of the country's name to Zimbabwe; the air force receiving its current name on 18th April 1980.

Twelve Chengdu F-7 IIN fighters, numbered 700-711, were delivered in 1986 and two Guizhou FT-7BZ trainers, (730 and 731) followed in 1991. They are operated by the 5 Sqn 'Arrows' at Thornhill-Gweru AB. Three were lost in January 2001 whilst en route to the Congo to join a flypast at the funeral of the President, Laurent Desiré Kabila. Reports of a further delivery of 12 have not been confirmed neither has that of an order for the more advanced F-7MG allegedly placed in 2004. The parlous state of the economy and the strong denials by CAC make these deliveries unlikely. Some of the fighters, known locally as F-7 IIs, mount two pylons; the rest, designated F-7 IIN, have four.

Zimbabwe Air Force F-7s and FT-7s

Serial	Version	Delivery	Unit	Comments
700	Chengdu F-7 IIN	1986	5 Sqn 'Arrows'	Crashed 14-11-1994
701	Chengdu F-7 IIN	1986	5 Sqn 'Arrows'	
702	Chengdu F-7 IIN	1986	5 Sqn 'Arrows'	
703	Chengdu F-7 IIN	1986	5 Sqn 'Arrows'	
704	Chengdu F-7 IIN	1986	5 Sqn 'Arrows'	White overall
705	Chengdu F-7 IIN	1986	5 Sqn 'Arrows'	
706	Chengdu F-7 IIN	1986	5 Sqn 'Arrows'	Grey/white colour scheme
707	Chengdu F-7 IIN	1986	5 Sqn 'Arrows'	White overall
708	Chengdu F-7 IIN	1986	5 Sqn 'Arrows'	White overall
709	Chengdu F-7 IIN	1986	5 Sqn 'Arrows'	White overall
710	Chengdu F-7 IIN	1986	5 Sqn 'Arrows'	Grey/white colour scheme
711	Chengdu F-7 IIN	1986	5 Sqn 'Arrows'	
730	Guizhou FT-7BZ	1986	5 Sqn 'Arrows'	White overall
731	Guizhou FT-7BZ	1986	5 Sqn 'Arrows'	White overall

Appendix

Production of MiG-21 variants in Gor'kiy

Version	MiG-21F	MiG-21F-13	MiG-21PF	MiG-21PFL	MiG-21PFS/PFM	MiG-21R	MiG-21S	MiG-21SM	MiG-21SMT	MiG-21bis	MiG-21MF	
	Izd. 72	*Izd.* 74	*Izd.* 76	*Izd.* 76	*Izd.* 94	*Izd.* 94R/03	*Izd.* 95	*Izd.* 95M/15	*Izd.* 50	*Izd.* 75	*Izd.* 96F	
Year												Total
1959	10											10
1960	73	132										205
1961		226	25	10								261
1962		155	135	35								325
1963			310	16	25							351
1964			47	52	320							419
1965			8	120	397							525
1966					202	63	25					290
1967						165	50					215
1968						79	70	30				179
1969						71		105				176
1970						30		150				180
1971						40		64	116			220
1972									135	35		170
1973									30	165		195
1974										210		210
1975										100	171	271
1976										150	60	210
1977										222		222
1978										172		172
1979										200		200
1980										200		200
1981										179		179
1982										140		140
1983										110		110
1984										121		121
1985										9		9
Total	**83**	**513**	**525**	**233**	**944**	**448**	**145**	**349**	**281**	**2,013**	**231**	**5,765**

MMZ No. 30 'Znamya Truda' in Moscow built a total of 3,203 MiG-21s in various versions. The Gor'kiy aircraft factory No. 21 named after Sergo Ordjonikidze (now the 'Sokol' Nizhniy Novgorod Aircraft Factory) manufactured 5,765 MiG-21s; the Tbilisi aircraft factory No. 31 named after Gheorgi Dimitrov (now Tbilaviamsheni) produced 1,677 units (17 single-seat fighters and 1,660 trainers). Thus, a grand total of 10,645 aircraft of the MiG-21 family was built in the USSR alone.

The MiG-21U was manufactured at the Tbilisi plant in 1962-66 (181 built) and at MMZ No. 30 in 1964-68 (for export only). The MiG-21US was manufactured in Tbilisi in 1966-70 (347 built) and was superseded on the production line in 1971 by the MiG-21UM (1,133 built).

Aero Vodochody in Czechoslovakia built 194 MiG-21F-13s under licence. Hindustan Aeronautics Ltd. in India produced a total of 657 MiG-21FL, MiG-21M and MiG-21bis fighters, including aircraft assembled from Soviet-supplied CKD kits. No production figures are available for China (the J-7 family).

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Known MiG-21s identified by construction number and/or fuselage number (line number) are listed here. The split presentation is purely for the sake of convenience. Crashed or destroyed aircraft are marked by 'RIP crosses' followed by the date of the accident.

Depending on the version, the c/n can be stencilled on the landing gear doors (occasionally in the mainwheel wells), the port side of the fuselage near the fuselage break point (and, on trainers, aft of the canopy), the port side of the vertical tail, the stabilator trailing edges, the ailerons (and on the wings next to the ailerons), the wing pylons and the airbrakes.

MiG-21 Family Production List

C/n	F/n	Version	Built	Tactical code/serial/registration
N63.21.01.01		Ye-2A		not known
N63.21.01.02		Ye-2A		not known
N63.21.01.03		Ye-2A		not known
N63.21.01.04		Ye-2A		Soviet AF (no code)
65.31.01.01		MiG-21		not known
65.31.01.02		MiG-21		not known
65.31.01.03		MiG-21		not known
65.31.01.04		MiG-21		not known
65.31.01.05		MiG-21		not known
65.31.01.06		MiG-21		not known
65.31.01.07		MiG-21		not known
65.31.01.08		MiG-21		not known
		MiG-21F		not known (Soviet AF)
N72.21.01.01		MiG-21F		Soviet AF (no code)
N72.21.02.06		MiG-21F		Soviet AF '01 Red'
N72.21.02.07		MiG-21F		Soviet AF '02 Red'?
N72.21.03.01		MiG-21F		Soviet AF '31 Red'
N72.21.03.02		MiG-21F		Soviet AF '32 Red'
N72.21.06.02		MiG-21F		Soviet AF '01 Red'
MiG-21F-13 – a) Gor'kiy production (plant No. 21)				
N74.21.01.04		MiG-21F-13		Soviet AF '01 Red'?
N74.21.03.01		MiG-21F-13, Ye-6V/2		Soviet AF (no code)
N74.21.08.03		MiG-21F-13		Soviet AF '45 Yellow'
N74.21.08.09		MiG-21F-13		not known (Soviet AF)
N74.21.03.13		MiG-21F-13		Soviet AF '21 Yellow'
N74.21.09.04		MiG-21F-13		Czechoslovak AF '0904 Black' No. 1
N74.21.12.17		MiG-21F-13		Polish AF 1217 Red
N74.21.13.25		MiG-21F-13		Soviet AF '58 Blue'
N74.21.14.05		MiG-21F-13		Cuban AF 411 Red
N74.21.14.10		MiG-21F-13		Soviet AF '97 Blue'
N74.21.17.06		MiG-21F-13		East German AF 701 Red † 30-12-1978, '7011 Red'
N74.21.17.07		MiG-21F-13		East German AF 705 Red
N74.21.17.08		MiG-21F-13		East German AF 790 Red † 22-10-1966
N74.21.17.09		MiG-21F-13		East German AF 618 Red
N74.21.17.10		MiG-21F-13		Romanian AF 10 Red
N74.21.17.11		MiG-21F-13		Romanian AF 11 Red
N74.21.17.12		MiG-21F-13		Romanian AF 12 Red
N74.21.18.01		MiG-21F-13		Hungarian AF 801 Red, Hungarian AF '1975', Hungarian AF 801 Red
N74.21.18.02		MiG-21F-13		Hungarian AF 802 Red † 26-9-1970
N74.21.18.03		MiG-21F-13		Hungarian AF 803 Red † 16-5-1968
N74.21.18.04		MiG-21F-13		Hungarian AF 804 Red † 5-10-1967
N74.21.18.05		MiG-21F-13		Hungarian AF 805 Red
N74.21.18.06		MiG-21F-13		Hungarian AF 806 Red, Hungarian AF '1976'
N74.21.18.07		MiG-21F-13		Hungarian AF 807 Red † 15-5-1975
N74.21.18.08		MiG-21F-13		Hungarian AF 808 Red
N74.21.18.09		MiG-21F-13		Hungarian AF 809 Red † 16-5-1963
N74.21.18.10		MiG-21F-13		Hungarian AF 810 Red, not known (Syrian AF)
N74.21.18.11		MiG-21F-13		Hungarian AF 811 Red
N74.21.18.12		MiG-21F-13		Hungarian AF 812 Red, not known (Syrian AF)
N74.21.18.13		MiG-21F-13		Hungarian AF 813 Red
N74.21.18.14		MiG-21F-13		Hungarian AF 814 Red
N74.21.18.15		MiG-21F-13		Hungarian AF 815 Red † 21-12-1967
N74.21.18.16		MiG-21F-13		Hungarian AF 816 Red
N74.21.18.17		MiG-21F-13		Hungarian AF 817 Red
N74.21.18.18		MiG-21F-13		Hungarian AF 818 Red † 31-8-1967
N74.21.18.19		MiG-21F-13		Hungarian AF 819 Red
N74.21.18.20		MiG-21F-13		Hungarian AF 820 Red
N74.21.18.21		MiG-21F-13		Hungarian AF 821 Red
N74.21.18.22		MiG-21F-13		Hungarian AF 822 Red
N74.21.18.23		MiG-21F-13		Hungarian AF 823 Red
N74.21.18.24		MiG-21F-13		Hungarian AF 824 Red
N74.21.18.25		MiG-21F-13		Hungarian AF 825 Red
N74.21.19.01		MiG-21F-13		Hungarian AF 901 Red † 17-7-1969
N74.21.19.02		MiG-21F-13		Hungarian AF 902 Red † 3-10-1972
N74.21.19.03		MiG-21F-13		Hungarian AF 903 Red
N74.21.19.04		MiG-21F-13		Hungarian AF 904 Red † 12-8-1963
N74.21.19.05		MiG-21F-13		Hungarian AF 905 Red, Hungarian AF '1981'
N74.21.19.06		MiG-21F-13		Hungarian AF 906 Red, not known (Syrian AF)
N74.21.19.07		MiG-21F-13		Hungarian AF 907 Red, Hungarian AF '1907'
N74.21.19.08		MiG-21F-13		Hungarian AF 908 Red † 31-7-1969
N74.21.19.09		MiG-21F-13		Hungarian AF 909 Red
N74.21.19.10		MiG-21F-13		Hungarian AF 910 Red † 11-5-1967
N74.21.19.11		MiG-21F-13		Hungarian AF 911 Red
N74.21.19.12		MiG-21F-13		Hungarian AF 912 Red † 14-7-1964
N74.21.19.13		MiG-21F-13		Hungarian AF 913 Red
N74.21.19.14		MiG-21F-13		Hungarian AF 914 Red
N74.21.19.15		MiG-21F-13		Hungarian AF 915 Red
N74.21.19.16		MiG-21F-13		East German AF 623 Red
N74.21.19.17		MiG-21F-13		East German AF 629 Red
N74.21.19.18		MiG-21F-13		East German AF 633 Red † 27-9-1967
N74.21.19.19		MiG-21F-13		East German AF 637 Red † 4-8-1964
N74.21.19.20		MiG-21F-13		East German AF 659 Red
N74.21.19.21		MiG-21F-13		East German AF 745 Red, EGAF '555 Red'
N74.21.19.22		MiG-21F-13		East German AF 639 Red
N74.21.19.23		MiG-21F-13		East German AF 642 Red
N74.21.19.24		MiG-21F-13		East German AF 645 Red
N74.21.19.25		MiG-21F-13		East German AF 649 Red † 16-1-1965
N74.21.20.01		MiG-21F-13		East German AF 661 Red, EGAF '049 Red'
N74.21.20.02		MiG-21F-13		East German AF 663 Red No. 1 † 7-1-1963
N74.21.20.03		MiG-21F-13		East German AF 696 Red † 16-12-1976
N74.21.20.04		MiG-21F-13		East German AF 652 Red † 13-9-1963
N74.21.20.05		MiG-21F-13		East German AF 702 Red † 12-10-1967
N74.21.20.06		MiG-21F-13		East German AF 744 Red
N74.21.20.07		MiG-21F-13		Polish AF 2007 Red, not known (Syrian AF)
N74.21.20.08		MiG-21F-13		Polish AF 2008
N74.21.20.09		MiG-21F-13		Polish AF 2009 Red, not known (Syrian AF)
N74.21.20.10		MiG-21F-13		East German AF 710 Red † 30-9-1963
N74.21.20.11		MiG-21F-13		East German AF 654 Red
N74.21.20.12		MiG-21F-13		East German AF 718 Red
N74.21.20.13		MiG-21F-13		East German AF 724 Red
N74.21.20.14		MiG-21F-13		East German AF 732 Red
N74.21.20.15		MiG-21F-13		Polish AF 2015 Red, 2015 White
N74.21.20.16		MiG-21F-13		Polish AF 2016 Red † 20-11-1963
N74.21.20.17		MiG-21F-13		Polish AF 2017 Red
N74.21.20.18		MiG-21F-13		Polish AF 2018 Red
N74.21.20.19		MiG-21F-13		Polish AF 2019 Red, not known (Syrian AF)
N74.21.21.01		MiG-21F-13		Indonesian AF F2158
N74.21.21.06		MiG-21F-13		Indonesian AF F2163
N74.21.21.07		MiG-21F-13		Indonesian AF F2157
N74.21.21.16		MiG-21F-13		Indonesian AF F2170
N74.21.22.16		MiG-21F-13		Romanian AF 16 Red
N74.21.22.19		MiG-21F-13		Hungarian AF 2219 Red † 20-5-1966
N74.21.22.20		MiG-21F-13		Polish AF 2220 Red
N74.21.22.21		MiG-21F-13		Hungarian AF 2221 Red
N74.21.22.22		MiG-21F-13		Hungarian AF 2222 Red † 18-8-1967
N74.21.22.23		MiG-21F-13		Polish AF 2223 Red, not known (Syrian AF)
N74.21.22.24		MiG-21F-13		Polish AF 2224 Red, not known (Syrian AF)
N74.21.23.07		MiG-21F-13		Polish AF 2307 Red
N74.21.23.11		MiG-21F-13		Hungarian AF 2311 Red
N74.21.23.12		MiG-21F-13		Hungarian AF 2312 Red † 2-5-1966
N74.21.23.13		MiG-21F-13		Hungarian AF 2313 Red
N74.21.23.14		MiG-21F-13		Hungarian AF 2314 Red † 2-5-1966
N74.21.23.15		MiG-21F-13		Hungarian AF 2315 Red, not known (Syrian AF)
N74.21.23.16		MiG-21F-13		Hungarian AF 2316 Red, Algerian AF 280
N74.21.23.17		MiG-21F-13		Hungarian AF 2317 Red † 1-3-1968
N74.21.23.18		MiG-21F-13		Hungarian AF 2318 Red
N74.21.23.19		MiG-21F-13		Hungarian AF 2319 Red, Hungarian AF '1981'
N74.21.23.20		MiG-21F-13		Hungarian AF 2320 Red † 5-6-1969

b) Moscow production (MMZ No. 30)

74.03.05	MiG-21F-13	Finnish AF MG-1, MG-31, 'MG-131'
74.04.01	MiG-21F-13	Finnish AF MG-2, MG-32, 'MG-129'
74.04.03	MiG-21F-13	Finnish AF MG-3, MG-33, 'MG-133'
74.04.04	MiG-21F-13	Finnish AF MG-4, MG-34, 'MG-124'
74.04.05	MiG-21F-13	Finnish AF MG-5, MG-35, 'MG-135'
74.04.06	MiG-21F-13	Finnish AF MG-6, MG-46, 'MG-116'
74.04.07	MiG-21F-13	Finnish AF MG-7, MG-47, 'MG-117'
74.04.08	MiG-21F-13	Finnish AF MG-8, MG-48, 'MG-118'
74.04.09	MiG-21F-13	Finnish AF MG-9, MG-49, 'MG-119'
74.04.10	MiG-21F-13	Finnish AF MG-10, MG-50, 'MG-140'
74.07.05	MiG-21F-13	Romanian AF 705 Red
74.07.06	MiG-21F-13	Romanian AF 706 Red
74.07.07	MiG-21F-13	Romanian AF 707 Red
74.07.08	MiG-21F-13	Romanian AF 708 Red
74.07.09	MiG-21F-13	Romanian AF 709 Red, 709 Black
74.07.10	MiG-21F-13	Romanian AF 710 Red
74.07.11	MiG-21F-13	Romanian AF 711 Red
74.07.12	MiG-21F-13	Romanian AF 712 Red
74.07.13	MiG-21F-13	Romanian AF 713 Red
74.07.14	MiG-21F-13	Romanian AF 714 Red
74.07.15	MiG-21F-13	Romanian AF 715 Red
74.08.01	MiG-21F-13	Romanian AF 801 Red
74.08.02	MiG-21F-13	Polish AF 802 Red, not known (Syrian AF)
74.08.03	MiG-21F-13	Polish AF 803 Red, not known (Syrian AF)
74.08.04	MiG-21F-13	Polish AF 804 Red † 13-10-1965
74.08.05	MiG-21F-13	Polish AF 805 Red
74.08.06	MiG-21F-13	Polish AF 806 Red
74.08.07	MiG-21F-13	Polish AF 807 Red
74.08.08	MiG-21F-13	Polish AF 808 Red
74.08.09	MiG-21F-13	Polish AF 809 Red
74.08.11	MiG-21F-13	Polish AF 811 Red
74.08.12	MiG-21F-13	Polish AF 812 Red
74.08.13	MiG-21F-13	Polish AF 813 Red
74.08.14	MiG-21F-13	Polish AF 814 Red † 23-6-1965
74.08.15	MiG-21F-13	East German AF 693 Red
74.09.01	MiG-21F-13	East German AF 679 Red, '696 Red'
74.09.02	MiG-21F-13	East German AF 622 Red
74.09.04	MiG-21F-13	East German AF 620 Red † 10-8-1968
74.09.05	MiG-21F-13	East German AF 624 Red
74.09.06	MiG-21F-13	East German AF 682 Red
74.09.07	MiG-21F-13	East German AF 734 Red
74.09.08	MiG-21F-13	East German AF 627 Red † 23-6-1965
74.09.09	MiG-21F-13	East German AF 675 Red † 8-8-1968
74.09.10	MiG-21F-13	East German AF 676 Red, '678 Red'
74.09.11	MiG-21F-13	East German AF 716 Red
74.09.12	MiG-21F-13	East German AF 672 Red † 25-5-1978
74.09.13	MiG-21F-13	East German AF 612 Red
74.09.14	MiG-21F-13	East German AF 713 Red
74.09.15	MiG-21F-13	East German AF 728 Red
74.10.01	MiG-21F-13	East German AF 666 Red † 2-4-1970
74.10.03	MiG-21F-13	East German AF 617 Red † 27-7-1965
74.10.04	MiG-21F-13	E. German AF 619 Red † 29-6-67, 'EGAF 335 Red'
74.10.05	MiG-21F-13	East German AF 684 Red
74.10.06	MiG-21F-13	East German AF 688 Red
74.10.07	MiG-21F-13	East German AF 689 Red
74.10.08	MiG-21F-13	East German AF 604 Red
74.10.09	MiG-21F-13	East German AF 605 Red
74.10.02	MiG-21F-13	East German AF 608 Red † 28-7-1964
74.10.10	MiG-21F-13	East German AF 712 Red
74.10.11	MiG-21F-13	Bulgarian AF '511 White'
74.10.12	MiG-21F-13	Bulgarian AF '512 White'
74.10.13	MiG-21F-13	Bulgarian AF '513 White'
74.10.14	MiG-21F-13	Bulgarian AF '514 White'
74.10.15	MiG-21F-13	Bulgarian AF '515 White'
74.10.16	MiG-21F-13	Bulgarian AF '516 White'
74.10.17	MiG-21F-13	Bulgarian AF '517 White'
74.10.18	MiG-21F-13	Bulgarian AF '518 White'
74.10.19	MiG-21F-13	Bulgarian AF '519 White'
74.10.20	MiG-21F-13	Bulgarian AF '520 White'
74.11.01	MiG-21F-13	Bulgarian AF '501 White'
74.11.17	MiG-21F-13	Finnish AF MG-61
74.11.19	MiG-21F-13	Finnish AF MG-62 † 2-7-1971
74.11.20	MiG-21F-13	Finnish AF MG-63 † 19-11-1977
74.12.01	MiG-21F-13	Finnish AF MG-64 † 20-5-1964
74.12.02	MiG-21F-13	Finnish AF MG-65, 'MG-125'
74.12.03	MiG-21F-13	Finnish AF MG-76 † 3-3-1976
74.12.04	MiG-21F-13	Finnish AF MG-77, 'MG-127'
74.12.05	MiG-21F-13	Finnish AF MG-78
74.12.06	MiG-21F-13	Finnish AF MG-79 † 8-9-1975
74.12.07	MiG-21F-13	Finnish AF MG-80 † 6-5-1970
74.12.08	MiG-21F-13	Finnish AF MG-91, 'MG-114'
74.12.11	MiG-21F-13	Hungarian AF 211 Red † 2-9-1971
74.12.12	MiG-21F-13	Hungarian AF 212 Red, not known (Syrian AF)
74.12.13	MiG-21F-13	Hungarian AF 213 Red † 12-2-1964
74.12.14	MiG-21F-13	Hungarian AF 214 Red, not known (Syrian AF)
74.12.15	MiG-21F-13	Hungarian AF 215 Red, not known (Syrian AF)
74.12.16	MiG-21F-13	Hungarian AF 216 Red, not known (Syrian AF)
74.12.17	MiG-21F-13	Hungarian AF 217 Red † 12-8-1963
74.12.18	MiG-21F-13	Hungarian AF 218 Red, Hungarian AF '15'
74.12.19	MiG-21F-13	Hungarian AF 219 Red
74.12.21	MiG-21F-13	Hungarian AF 221 Red † 10-7-1964
74.12.22	MiG-21F-13	Hungarian AF 222 Red, not known (Syrian AF)
74.12.23	MiG-21F-13	Hungarian AF 223 Red † 5-2-1964
74.12.24	MiG-21F-13	Hungarian AF 224 Red
74.12.25	MiG-21F-13	Hungarian AF 225 Red, Hungarian AF 1225 Red, Hungarian AF '1981'
74.13.01	MiG-21F-13	Hungarian AF 01 Red, Hungarian AF '25'
74.13.02	MiG-21F-13	Hungarian AF 302 Red, not known (Syrian AF)
74.13.03	MiG-21F-13	Hungarian AF 303 Red † 13-9-1966
74.13.04	MiG-21F-13	Hungarian AF 304 Red † 10-5-1969
74.13.05	MiG-21F-13	Hungarian AF 305 Red
74.13.06	MiG-21F-13	Hungarian AF 306 Red, not known (Syrian AF)
74.13.07	MiG-21F-13	Hungarian AF 307 Red † 23-6-1966
74.13.08	MiG-21F-13	Hungarian AF 308 Red
74.13.09	MiG-21F-13	Hungarian AF 309 Red † 1-3-1966
74.13.11	MiG-21F-13	Hungarian AF 311 Red, not known (Syrian AF)
74.13.12	MiG-21F-13	Hungarian AF 312 Red † 9-9-1971
74.13.13	MiG-21F-13	Hungarian AF 313 Red
74.13.14	MiG-21F-13	Hungarian AF 314 Red, not known (Syrian AF)
74.13.20	MiG-21F-13	Hungarian AF 320 Red, not known (Syrian AF)
74.13.24	MiG-21F-13	Hungarian AF 324 Red, not known (Syrian AF)
74.14.14	MiG-21F-13	Hungarian AF 414 Red
74.15.13	MiG-21F-13	Yugoslav AF 22518
74.15.22	MiG-21F-13	East German AF 625 Red † 19-5-1991
74.15.23	MiG-21F-13	East German AF 626 Red † 13-12-1964
74.15.24	MiG-21F-13	East German AF 635 Red
74.15.25	MiG-21F-13	East German AF 663 Red No. 2
74.16.01	MiG-21F-13	East German AF 669 Red
74.16.02	MiG-21F-13	East German AF 628 Red
74.16.03	MiG-21F-13	East German AF 631 Red † 13-8-1965
74.16.04	MiG-21F-13	East German AF 720 Red
74.16.05	MiG-21F-13	East German AF 721 Red † 1-10-1964
74.16.06	MiG-21F-13	East German AF 726 Red
74.16.07	MiG-21F-13	East German AF 736 Red
74.16.08	MiG-21F-13	East German AF 737 Red
74.16.09	MiG-21F-13	East German AF 759 Red † 12-10-1977
74.16.10	MiG-21F-13	East German AF 714 Red
74.16.11	MiG-21F-13	East German AF 708 Red
74.16.12	MiG-21F-13	East German AF 741 Red
74.16.13	MiG-21F-13	East German AF 699 Red † 16-8-1967
74.16.14	MiG-21F-13	East German AF 747 Red
74.16.15	MiG-21F-13	East German AF 678 Red
74.16.16	MiG-21F-13	East German AF 749 Red
74.16.17	MiG-21F-13	East German AF 644 Red
74.16.18	MiG-21F-13	East German AF 641 Red
74.16.19	MiG-21F-13	East German AF 677 Red
74.16.20	MiG-21F-13	East German AF 671 Red, '1801 Red', '268 Red'

74.16.21	MiG-21F-13	East German AF 797 Red † 25-9-1969
74.17.02	MiG-21F-13	Yugoslav AF 22532
74.17.21	MiG-21F-13	Finnish AF MG-92

MiG-21PF – a) Gor'kiy production

N76.21.01.01	MiG-21PF	Soviet AF (no code)
N76.21.01.03	MiG-21PF, Ye-7SPS, Ye-7M	Soviet AF (no code)
N76.21.05.01	MiG-21PF	not known (Soviet AF)
N76.21.07.03	MiG-21PF	not known (Soviet AF)
N76.21.07.25	MiG-21PF	Soviet AF (no code)
N76.21.08.20	MiG-21PF	Soviet AF '02 Red'
N76.21.08.25	MiG-21PF, Ye-7R	Soviet AF (no code), Soviet AF '78 Red'
N76.21.13.25	MiG-21PF	not known (Soviet AF)
N76.21.16.15	MiG-21PF	not known (Soviet AF)
N76.21.17.01	MiG-21PF	not known (Soviet AF)
N76.21.21.06	MiG-21PF	not known (Soviet AF)
N76.21.21.09	MiG-21PFL	Vietnamese People's AF 4324 Red
N76.21.21.10	MiG-21PF	Soviet AF '95 Yellow'
N76.21.21.22	MiG-21PF	Soviet AF '16 Red'
N76.21.23.18	MiG-21PF	Soviet AF '98 Red'

b) Moscow production

76.03.01	MiG-21PF	Czechoslovak AF 0301 Black † 28-6-1985
76.03.02	MiG-21PF	Czechoslovak AF 0302 Black
76.03.03	MiG-21PF	Czechoslovak AF 0303 Black † 30-8-1965
76.03.04	MiG-21PF	Czechoslovak AF 0304 Black † 26-10-1971
76.03.05	MiG-21PF	Czechoslovak AF 0305 Black † 4-12-1965
76.03.06	MiG-21PF	Czechoslovak AF 0306 Black
76.03.07	MiG-21PF	Czechoslovak AF 0307 Black † 5-4-1967
76.03.08	MiG-21PF	Czechoslovak AF 0308 Black
76.03.09	MiG-21PF	Czechoslovak AF 0309 Black
76.03.10	MiG-21PF	Czechoslovak AF 0310 Black
76.04.01	MiG-21PF	Czechoslovak AF 0401 Black
76.04.02	MiG-21PF	Czechoslovak AF 0402 Black
76.04.03	MiG-21PF	Czechoslovak AF 0403 Black
76.04.04	MiG-21PF	Czechoslovak AF 0404 Black
76.04.05	MiG-21PF	Czechoslovak AF 0405 Black † 23-6-1990
76.04.06	MiG-21PF	Hungarian AF 406 Red
76.04.07	MiG-21PF	Hungarian AF 407 Red † 31-1-1968
76.04.08	MiG-21PF	Hungarian AF 408 Red
76.04.09	MiG-21PF	Hungarian AF 409 Red, Hungarian AF '1989'
76.05.01	MiG-21PF	Hungarian AF 501 Red
76.05.02	MiG-21PF	Hungarian AF 502 Red † 25-3-1986
76.05.03	MiG-21PF	Hungarian AF 503 Red
76.05.04	MiG-21PF	Hungarian AF 504 Red
76.05.05	MiG-21PF	Hungarian AF 505 Red, Hungarian AF '1989', Hungarian AF 505 Red
76.05.06	MiG-21PF	Hungarian AF 506 Red, G-BRAN, N316DM
76.05.07	MiG-21PF	Hungarian AF 507 Red
76.05.08	MiG-21PF	Hungarian AF 508 Red
76.05.09	MiG-21PF	Hungarian AF 509 Red
76.05.10	MiG-21PF	Hungarian AF 10 Red
76.05.11	MiG-21PF	East German AF 805 Red † 12-10-1965
76.05.12	MiG-21PF	East German AF 807 Red † 7-4-1967
76.05.13	MiG-21PF	East German AF 809 Red † 29-8-1986
76.05.14	MiG-21PF	East German AF 812 Red
76.05.15	MiG-21PF	East German AF 814 Red † 11-8-1967
76.06.02	MiG-21PF	East German AF 816 Red
76.06.03	MiG-21PF	East German AF 818 Red † 25-3-1974
76.06.04	MiG-21PF	East German AF 821 Red, '992 Red', '821 Red'
76.06.05	MiG-21PF	East German AF 823 Red
76.06.06	MiG-21PF	East German AF 825 Red
76.06.07	MiG-21PF	Polish AF 0607 Red
76.06.08	MiG-21PF	Polish AF 0608 Red
76.06.09	MiG-21PF	East German AF 828 Red
76.06.10	MiG-21PF	Polish AF 0610 Red
76.06.11	MiG-21PF	East German AF 830 Red † 29-4-1969
76.06.12	MiG-21PF	Polish AF 0612 Red
76.06.13	MiG-21PF	Polish AF 0613 Red
76.06.14	MiG-21PF	Polish AF 0614 Red
76.06.15	MiG-21PF	Polish AF 0615 Red
76.07.01	MiG-21PF	Polish AF 0701 Red
76.07.02	MiG-21PF	Polish AF 0702 Red
76.07.03	MiG-21PF	Polish AF 0703 Red
76.07.04	MiG-21PF	Polish AF 0704 Red † 14-8-1978
76.07.05	MiG-21PF	Polish AF 0705 Red
76.07.05	MiG-21PF	Romanian AF 705
76.07.06	MiG-21PF	Romanian AF 706 Red
76.07.07	MiG-21PF	Romanian AF 707
76.07.08	MiG-21PF	Romanian AF 708 Red
76.07.09	MiG-21PF	Romanian AF 709
76.07.10	MiG-21PF	Romanian AF 710
76.07.11	MiG-21PF	Romanian AF 711 Red
76.07.12	MiG-21PF	Romanian AF 712
76.07.13	MiG-21PF	Romanian AF 713 Red
76.07.14	MiG-21PF	Romanian AF 714 Red
76.07.15	MiG-21PF	Romanian AF 715 Red
76.08.01	MiG-21PF	Romanian AF 801
76.08.02	MiG-21PF	Romanian AF 802
76.08.03	MiG-21PF	Romanian AF 803
76.08.04	MiG-21PF	Bulgarian AF '20'
76.08.05	MiG-21PF	Bulgarian AF '21' † 1975
76.08.07	MiG-21PF	Czechoslovak AF 0807 Black
76.08.08	MiG-21PF	Bulgarian AF '022'
76.08.09	MiG-21PF	Czechoslovak AF 0809 Black
76.08.10	MiG-21PF	Czechoslovak AF 0810 Black
76.08.11	MiG-21PF	East German AF 862 Red
76.08.12	MiG-21PF	Czechoslovak AF 0812 Black
76.08.13	MiG-21PF	Bulgarian AF '223', 'Bulgarian AF 123 White'
76.08.14	MiG-21PF	Bulgarian AF '224'
76.08.15	MiG-21PF	Bulgarian AF '125', 'Bulgarian AF 123'
76.09.01	MiG-21PF	Polish AF 0901 Red
76.09.02	MiG-21PF	Polish AF 0902 Red
76.09.03	MiG-21PF	Polish AF 0903 Red
76.09.04	MiG-21PF	Bulgarian AF '26'?
76.09.05	MiG-21PF	Polish AF 0905 Red † 11-5-1971
76.09.06	MiG-21PF	Polish AF 0906 Red
76.09.07	MiG-21PF	Polish AF 0907 Red
76.09.08	MiG-21PF	Bulgarian AF '28'
76.09.09	MiG-21PF	Bulgarian AF '29'
76.09.10	MiG-21PF	Bulgarian AF '030'
76.09.11	MiG-21PF	Bulgarian AF '31'
76.09.12	MiG-21PF	Czechoslovak AF 0912 Black
76.09.13	MiG-21PF	East German AF 864 Red
76.09.14	MiG-21PF	East German AF 870 Red, 'IRIAF 3-0914'
76.09.15	MiG-21PF	East German AF 874 Red † 14-10-1966
76.10.01	MiG-21PF	East German AF 832 Red
76.10.02	MiG-21PF	East German AF 835 Red † 25-6-1965
76.10.03	MiG-21PF	East German AF 837 Red † 30-6-1965
76.10.04	MiG-21PF	East German AF 840 Red
76.10.05	MiG-21PF	East German AF 843 Red
76.10.06	MiG-21PF	East German AF 846 Red
76.10.07	MiG-21PF	East German AF 848 Red No. 1 † 2-10-1976
76.10.08	MiG-21PF	East German AF 851 Red ['1851 Red']
76.10.09	MiG-21PF	East German AF 854 Red
76.10.10	MiG-21PF	East German AF 858 Red
76.10.11	MiG-21PF	East German AF 860 Red † 5-9-1966
76.10.12	MiG-21PF	East German AF 877 Red, '1982 Red', 'Luftwaffe 23+82'
76.11.03	MiG-21PF	East German AF 868 Red
76.11.04	MiG-21PF	East German AF 881 Red † 5-5-1966
76.11.05	MiG-21PF	East German AF 883 Red
76.11.06	MiG-21PF	East German AF 885 Red
76.11.07	MiG-21PF	East German AF 887 Red † 11-10-1974 (11-4-1974?)
76.11.08	MiG-21PF	East German AF 890 Red; N6285D?
76.11.09	MiG-21PF	East German AF 893 Red; N6285L?
76.11.10	MiG-21PF	East German AF 896
76.11.11	MiG-21PF	East German AF 899 Red † 1-10-1971
76.11.12	MiG-21PF	East German AF 901
76.11.13	MiG-21PF	East German AF 908 ['1908 Red']

76.11.14	MiG-21PF	East German AF 913 Red † 4-8-1968
76.11.15	MiG-21PF	East German AF 918
76.12.01	MiG-21PF	East German AF 920 Red † 11-10-1974 (11-4-1974?)
76.12.02	MiG-21PF	East German AF 922 Red † 27-4-1971
76.12.03	MiG-21PF	East German AF 928 Red † 15-6-1972
76.12.04	MiG-21PF	East German AF 931 Red † 5-2-1970
76.12.05	MiG-21PF	East German AF 934 Red
76.12.07	MiG-21PF	East German AF 936 (1) Red † 20-3-1972
76.12.08	MiG-21PF	East German AF 939 Red † 6-5-1988
76.12.09	MiG-21PF	East German AF 942 Red
76.12.10	MiG-21PF	East German AF 944 Red
76.12.11	MiG-21PF	East German AF 947 Red
76.12.12	MiG-21PF	Czechoslovak AF 1212 Black
76.12.13	MiG-21PF	Czechoslovak AF 1213 Black
76.12.14	MiG-21PF	Czechoslovak AF 1214 Black
76.12.15	MiG-21PF	Czechoslovak/Slovak AF 1215 Black
76.13.01	MiG-21PF	Czechoslovak AF 1301 Black
76.13.02	MiG-21PF	Czechoslovak AF 1302 Black
76.13.03	MiG-21PF	Czechoslovak AF 1303 Black
76.13.04	MiG-21PF	Czechoslovak AF 1304 Black, N5179Y
76.13.05	MiG-21PF	Czechoslovak AF 1305 Black † 29-9-1972
76.13.06	MiG-21PF	Czechoslovak AF 1306 Black
76.13.07	MiG-21PF	Czechoslovak AF 1307 Black
76.13.08	MiG-21PF	Czechoslovak AF 1308 Black
76.13.09	MiG-21PF	Czechoslovak AF 1309 Black, N121MG
76.13.10	MiG-21PF	Czechoslovak AF 1310 Black † 11-1-1975
76.13.11	MiG-21PF	Czechoslovak AF 1311 Black
76.13.12	MiG-21PF	Czechoslovak AF 1312 Black
76.13.13	MiG-21PF	Czechoslovak AF 1313 Black
76.13.14	MiG-21PF	Czechoslovak AF 1314 Black † 13-10-1989
76.13.15	MiG-21PF	Czechoslovak AF 1315 Black † 12-11-1974
76.14.01	MiG-21PF	Romanian AF 401
76.14.02	MiG-21PF	East German AF 950 Red
76.14.03	MiG-21PF	Romanian AF 403 Red
76.14.04	MiG-21PF	Romanian AF 404 Red
76.14.05	MiG-21PF	Romanian AF 405 Red
76.14.06	MiG-21PF	Romanian AF 406 Red
76.14.07	MiG-21PF	Romanian AF 407
76.14.08	MiG-21PF	Romanian AF 408 Red
76.14.09	MiG-21PF	Romanian AF 409
76.14.10	MiG-21PF	Romanian AF 410 Red
76.14.11	MiG-21PF	Romanian AF 411 White outline
76.14.12	MiG-21PF	Romanian AF 412 Red
76.14.13	MiG-21PF	Romanian AF 413 Red
76.14.14	MiG-21PF	Romanian AF 414 Red
76.14.15	MiG-21PF	Romanian AF 415 White outline
76.15.01	MiG-21PF	Romanian AF 501 Red
76.15.02	MiG-21PF	Romanian AF 502
76.15.03	MiG-21PF	Romanian AF 503 White outline
76.15.04	MiG-21PF	Romanian AF 504 White outline
76.15.05	MiG-21PF	Romanian AF 505 White outline
76.15.06	MiG-21PF	Polish AF 1506 Red
76.15.07	MiG-21PF	Romanian AF 507 Red
76.15.08	MiG-21PF	Romanian AF 508 White outline
76.15.09	MiG-21PF	Romanian AF 509 Red
76.15.10	MiG-21PF	Romanian AF 510 White outline
76.15.11	MiG-21PF	Hungarian AF 1511 Red † 17-10-1968
76.15.12	MiG-21PF	Hungarian AF 1512 Red
76.15.13	MiG-21PF	Hungarian AF 1513 Red † 2-4-1968
76.15.14	MiG-21PF	Hungarian AF 1514 Red, Hungarian AF '14'
76.15.15	MiG-21PF	Hungarian AF 1515 Red † 10-4-1980
76.16.01	MiG-21PF	Hungarian AF 1601 Red
76.16.02	MiG-21PF	Hungarian AF 602 Red
76.16.03	MiG-21PF	Hungarian AF 1603 Red, G-BRAO, N621DM, N21MG, 'VPAF 4326 Red'
76.16.04	MiG-21PF	Hungarian AF 1604 Red † 23-4-1971
76.16.05	MiG-21PF	Hungarian AF 1605 Red
76.16.06	MiG-21PF	Polish AF 1606 Red
76.16.07	MiG-21PF	Polish AF 1607 Red
76.16.08	MiG-21PF	Polish AF 1608 Red
76.16.09	MiG-21PF	Polish AF 1609 Red
76.16.09	MiG-21PF	Romanian AF 609
76.16.10	MiG-21PF	Polish AF 1610 Red
76.16.11	MiG-21PF	Polish AF 1611 Red
76.16.12	MiG-21PF	Polish AF 1612 Red
76.16.13	MiG-21PF	Polish AF 1613 Red
76.16.14	MiG-21PF	Polish AF 1614 Red
76.16.15	MiG-21PF	Polish AF 1615 Red
76.17.01	MiG-21PF	Polish AF 1701 Red
76.17.02	MiG-21PF	Polish AF 1702 Red
76.17.03	MiG-21PF	Polish AF 1703 Red
76.17.04	MiG-21PF	Polish AF 1704 Red
76.17.05	MiG-21PF	Polish AF 1705 Red † 22-3-1979
76.17.06	MiG-21PF	Polish AF 1706 Red
76.17.07	MiG-21PF	Polish AF 1707 Red
76.17.08	MiG-21PF	Polish AF 1708 Red
76.17.09	MiG-21PF	Polish AF 1709 Red
76.17.10	MiG-21PF	Polish AF 1710 Red
76.17.11	MiG-21PF	Polish AF 1711 Red † 23-2-1966
76.17.12	MiG-21PF	Polish AF 1712 Red
76.17.13	MiG-21PF	Polish AF 1713 Red
76.17.14	MiG-21PF	Polish AF 1714 Red
76.17.15	MiG-21PF	Polish AF 1715 Red
76.18.01	MiG-21PF	Polish AF 1801 Red
76.18.02	MiG-21PF	Polish AF 1802 Red
76.18.03	MiG-21PF	Polish AF 1803 Red
76.18.04	MiG-21PF	Polish AF 1804 Red
76.18.05	MiG-21PF	Polish AF 1805 Red
76.18.06	MiG-21PF	Polish AF 1806 Red
76.18.07	MiG-21PF	Polish AF 1807 Red
76.18.08	MiG-21PF	Polish AF 1808 Red
76.18.09	MiG-21PF	Polish AF 1809 Red
76.18.10	MiG-21PF	Polish AF 1810 Red
76.18.11	MiG-21PF	Polish AF 1811 Red, N21PF
76.18.13	MiG-21PF	Polish AF 1813 Red
76.18.14	MiG-21PF	Polish AF 1814 Red
76.18.15	MiG-21PF	Polish AF 1815 Red, '1974'
76.19.01	MiG-21PF	Polish AF 1901 Red
76.19.02	MiG-21PF	Polish AF 1902 Red
76.19.03	MiG-21PF	Polish AF 1903 Red
76.19.04	MiG-21PF	Polish AF 1904 Red
76.19.11	MiG-21PF	Polish AF 1911 Red, 'Cuban AF 1006 Red'
76.19.13	MiG-21PF	Polish AF 1913 Red
76.20.02	MiG-21PF	Polish AF 2002 Red
76.20.03	MiG-21PF	Polish AF 2003 Red
76.20.04	MiG-21PF	Polish AF 2004 Red
76.20.05	MiG-21PF	Polish AF 2005 Red
76.20.06	MiG-21PF	Polish AF 2006 Red
76.20.07	MiG-21PF	Polish AF 2007 Red
76.20.08	MiG-21PF	Polish AF 2008 Red † 17-4-1967
76.20.09	MiG-21PF	Polish AF 2009 Red No. 1
76.20.10	MiG-21PF	Polish AF 2010 Red
76.24.01	MiG-21PF	Polish AF 2401 Red
76.24.02	MiG-21PF	Polish AF 2402 Red
76.24.03	MiG-21PF	Polish AF 2403 Red † 22-1-1968
76.24.04	MiG-21PF	Polish AF 2404 Red
76.24.05	MiG-21PF	Polish AF 2405 Red † 30-6-1966
76.24.06	MiG-21PF	Polish AF 2406 Red
76.24.07	MiG-21PF	Polish AF 2407 Red
76.24.08	MiG-21PF	Polish AF 2408 Red
76.24.09	MiG-21PF	Polish AF 2409 Red † 2-8-1979
76.24.10	MiG-21PF	Polish AF 2410 Red, N21MF
76.24.11	MiG-21PF	Polish AF 411 Red?, Polish AF 2411 Red
76.24.12	MiG-21PF	Polish AF 2412 Red
760.74.01	MiG-21PF	Sudanese AF 201
760.74.02	MiG-21PF	Sudanese AF 202
760.74.03	MiG-21PF	Sudanese AF 203
760.74.04	MiG-21PF	Sudanese AF 204
760.74.05	MiG-21PF	Sudanese AF 205

760.74.06		MiG-21PF	Sudanese AF 206
760.74.07		MiG-21PF	Sudanese AF 207
760.74.08		MiG-21PF	Sudanese AF 208
760.74.09		MiG-21PF	Sudanese AF 209
760.74.10		MiG-21PF	Sudanese AF 210
760.74.11		MiG-21PF	Sudanese AF 211
760.74.12		MiG-21PF	Sudanese AF 212
760.74.13		MiG-21PF	Sudanese AF 213
760.74.14		MiG-21PF	Sudanese AF 214
760.74.15		MiG-21PF	Sudanese AF 215
760.74.16		MiG-21PF	Sudanese AF 216
760.74.17		MiG-21PF	Sudanese AF 217
760.74.18		MiG-21PF	Sudanese AF 218
940 SO 12	0312	MiG-21PFM	Bulgarian AF '25'
94.07.24		MiG-21PFS, MiG-21R	not known (Soviet AF)
94.07.35		MiG-21PFS, MiG-21R	not known (Soviet AF)
N94.21.04.25		MiG-21PFS	Soviet AF '09 Blue', '09 Red'
N94.21.08.10		MiG-21PFS	Soviet AF '14 Blue'
N94.21.10.14		MiG-21PFS	Soviet AF '57 White outline'
N94.21.14.18		MiG-21PFS	not known (Vietnamese People's AF), VPAF '6144'
N94.21.15.08		MiG-21PFS	Bulgarian AF '72'
N94.21.15.11		MiG-21PFS	Bulgarian AF '78 White'
N94.21.15.16		MiG-21PFS	Bulgarian AF '49'
940ACh09	1709	MiG-21PFM	Bulgarian AF '51'
940ACh10	1710	MiG-21PFM	Bulgarian AF '75'
940ACh13	1713	MiG-21PFM	Bulgarian AF '77'
940ACh15	1715	MiG-21PFM	Bulgarian AF '85'
940ACh17	1717	MiG-21PFS, M-21	not known (SovAF), Soviet/Ukrainian AF '45 Red outline'
940ACh23	1723	MiG-21PFM	Bulgarian AF '50'
940AK14	1914	MiG-21PFM	Soviet AF '49 Red'
940MS01	2001	MiG-21PFM	not known (Soviet AF)
940MS13	2013	MiG-21PFM	Soviet AF '21 Red', '45 Red'
940MA08	2108	MiG-21PFM	Bulgarian AF '27'
940MA19	2119	MiG-21PFM	Bulgarian AF '74'
940MM20	2220	MiG-21PFM	Bulgarian AF '73'
940 MO 05	2305	MiG-21PFM	Bulgarian AF '36 White'
940 MO 06	2306	MiG-21PFM	Bulgarian AF '37'
940 MO 07	2307	MiG-21PFM	Bulgarian AF '38'
940 MO 08	2308	MiG-21PFM	Bulgarian AF '39 Red'
940 MO 09	2309	MiG-21PFM	Bulgarian AF '40'
940 MO 10	2310	MiG-21PFM	Bulgarian AF '41'
940 MO 11	2311	MiG-21PFM	Bulgarian AF '42'
940 MO 12	2312	MiG-21PFM	not known (SovAF), Russian AF '227 White outline'
940 MO 13	2313	MiG-21PFM	Bulgarian AF '43 White'
940 MO 15	2315	MiG-21PFM	Bulgarian AF '44'
940 MO 16	2316	MiG-21PFM	Bulgarian AF '45'
940 MO 17	2317	MiG-21PFM	Bulgarian AF '46'
940 MO 18	2318	MiG-21PFM	Bulgarian AF '28'
940 MO 22	2322	MiG-21PFM (*izd.* 94A)	Polish AF 022 Red
940 MO 23	2323	MiG-21PFM	Bulgarian AF '31'
940ML01	2401	MiG-21PFM (*izd.* 94A)	Polish AF 01 Red
940ML02	2402	MiG-21PFM	Bulgarian AF '70'
940ML03	2403	MiG-21PFM (*izd.* 94A)	Polish AF 03 Red
940ML04	2404	MiG-21PFM (*izd.* 94A)	Polish AF 04 Red
940ML05	2405	MiG-21PFM (*izd.* 94A)	Polish AF 05 Red
940ML06	2406	MiG-21PFM (*izd.* 94A)	Polish AF 06 Red
940ML07	2407	MiG-21PFM (*izd.* 94A)	Polish AF 07 Red † 23-1-1968
940ML08	2408	MiG-21PFM (*izd.* 94A)	Polish AF 08 Red
940ML09	2409	MiG-21PFM (*izd.* 94A)	Polish AF 09 Red
940ML10	2410	MiG-21PFM (*izd.* 94A)	Polish AF 10 Red
940ME10	2510	MiG-21PFM	Bulgarian AF '62 White', 'Bulgarian AF 7294'
940ME22	2522	MiG-21PFM	Bulgarian AF '32'
940MT04	2604	MiG-21PFM	Bulgarian AF '68 White'
940MT09	2609	MiG-21PFM	Bulgarian AF '29'
940 MI 12	2812	MiG-21PFM	Bulgarian AF '76'
940 MI 23	2823	MiG-21PFM	Bulgarian AF '33'
940 MI 24	2824	MiG-21PFM	Bulgarian AF '71'
940MK03	2903	MiG-21PFM	Bulgarian AF '64'
940MK05	2905	MiG-21PFM	Bulgarian AF '35' † 10-4-1969
940MK10	2910	MiG-21PFM	Bulgarian AF '26'
940MK13	2913	MiG-21PFM	Bulgarian AF '940'
940MK20	2920	MiG-21PFM	Bulgarian AF '67'
940 OS 03	3003	MiG-21PFM	Bulgarian AF '66 White' No. 1
940 OS 13	3013	MiG-21PFM	Bulgarian AF '48'
940 OS 14	3014	MiG-21PFM	Bulgarian AF '61'
940 OS 17	3017	MiG-21PFM	Bulgarian AF '63'
940 OS 18	3018	MiG-21PFM	Bulgarian AF '65'
940 OS 19	3019	MiG-21PFM	Bulgarian AF '69'
940 OA 04	3104	MiG-21PFM	Bulgarian AF '34' † 5-10-1989
940 OA 10	3110	MiG-21PFM	Bulgarian AF '30'
940 OA 12	3112	MiG-21PFM	Bulgarian AF '47'
940 OM 24	3224	MiG-21PFM	Soviet AF '27 Red'
94.40.06		MiG-21PFM	East German AF 703 Red, Luftwaffe 22+22
94.40.07		MiG-21PFM	E. German AF 704 Red ['17043 Red'] † 8-1-1981
94.40.08		MiG-21PFM	East German AF 706 Red † 1-9-1980
94.40.09		MiG-21PFM	East German AF 709 Red
94A.40.10		MiG-21PFM (*izd.* 94A)	Polish AF 4010 Red No. 1
94A.40.11		MiG-21PFM (*izd.* 94A)	Polish AF 4011 Red
94A.40.12		MiG-21PFM (*izd.* 94A)	Polish AF 4012 Red
94A.40.13		MiG-21PFM (*izd.* 94A)	Polish AF 4013 Red
94A.40.14		MiG-21PFM (*izd.* 94A)	Polish AF 4014 Red
94A.40.15		MiG-21PFM (*izd.* 94A)	Polish AF 4015 Red
94A.41.01		MiG-21PFM (*izd.* 94A)	Polish AF 4101 Red
94A.41.02		MiG-21PFM (*izd.* 94A)	Polish AF 4102 Red
94A.41.03		MiG-21PFM (*izd.* 94A)	Polish AF 4103 Red
94A.41.04		MiG-21PFM (*izd.* 94A)	Polish AF 4104 Red
94A.41.05		MiG-21PFM (*izd.* 94A)	Polish AF 4105 Red
94A.41.06		MiG-21PFM (*izd.* 94A)	Polish AF 4106 Red
94A.41.07		MiG-21PFM (*izd.* 94A)	Polish AF 4107 Red
94A.41.08		MiG-21PFM (*izd.* 94A)	Polish AF 4108 Red
94A.41.09		MiG-21PFM (*izd.* 94A)	Polish AF 4109 Red
94A.41.10		MiG-21PFM (*izd.* 94A)	Polish AF 4110 Red † 4-4-1967
94A.41.11		MiG-21PFM (*izd.* 94A)	Polish AF 4111 Red † 19-6-1967
94A.41.14		MiG-21PFM (*izd.* 94A)	Polish AF 4114 Red
94A.41.15		MiG-21PFM (*izd.* 94A)	Polish AF 4115 Red
94A.42.01		MiG-21PFM (*izd.* 94A)	Polish AF 4201 Red
94A.42.03		MiG-21PFM (*izd.* 94A)	Polish AF 4203 Red
94A.42.04		MiG-21PFM (*izd.* 94A)	Polish AF 4204 Red † 23-1-1968
94A.42.05		MiG-21PFM (*izd.* 94A)	Polish AF 4205 Red
94A.42.06		MiG-21PFM (*izd.* 94A)	Polish AF 4206 Red
94A.42.07		MiG-21PFM (*izd.* 94A)	Polish AF 4207 Red
94.42.08		MiG-21PFM	East German AF 711 Red No. 1 † 13-9-1989
94.42.09		MiG-21PFM	East German AF 717 Red, Luftwaffe 22+23
94.42.10		MiG-21PFM	East German AF 719 Red † 3-5-1968
94.42.11		MiG-21PFM	East German AF 722 Red
94.42.12		MiG-21PFM	East German AF 725 Red
94.42.13		MiG-21PFM	East German AF 729 Red, Luftwaffe 22+24
94.42.14		MiG-21PFM	East German AF 730 Red † 8-5-1980
94.42.15		MiG-21PFM	East German AF 733 Red
94.43.01		MiG-21PFM	East German AF 738 Red, Luftwaffe 22+25, 'Indian Air Force C993'
94.43.02		MiG-21PFM	East German AF 740 Red, Luftwaffe 22+26
94.43.03		MiG-21PFM	East German AF 742 Red, Luftwaffe 22+27
94.43.04		MiG-21PFM	East German AF 750 Red
94.43.05		MiG-21PFM	East German AF 751 Red
94.43.06		MiG-21PFM	East German AF 755 Red † 18-5-1968
94.43.07		MiG-21PFM	East German AF 756 Red ['17568 Red']
94.43.08		MiG-21PFM	East German AF 758 Red
94.43.09		MiG-21PFM	East German AF 760 Red, Luftwaffe 22+28
94.43.10		MiG-21PFM	East German AF 780 Red, Luftwaffe 22+30, 'EGAF 780 Red'
94A.43.11		MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4311 Black † 6-1-1970
94A.43.12		MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4312 Black † 6-1-1970
94.43.13		MiG-21PFM	East German AF 763 Red
94.43.14		MiG-21PFM	East German AF 764 Red
94A.43.15		MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4315 Black
94A.44.01		MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4401 Black

94A.44.02	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4402 Black
94A.44.03	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4403 Black † 1-6-1968
94A.44.04	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4404 Black
94A.44.05	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4405 Black
94A.44.06	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4406
94A.44.07	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4407
94A.44.08	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4408
94A.44.09	MiG-21PFM (*izd.* 94A)	Czechoslovak/Slovak AF 4409
94A.44.10	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4410 Black
94A.44.11	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4411 Black
94A.44.12	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4412 Black † 2-11-1988
94A.44.13	MiG-21PFM (*izd.* 94A)	Czechoslovak/Slovak AF 4413 Black
94A.44.14	MiG-21PFM (*izd.* 94A)	Czechoslovak/Slovak AF 4414 Black
94A.44.15	MiG-21PFM (*izd.* 94A)	Czechoslovak/Slovak AF 4415 Black
94.45.01	MiG-21PFM	East German AF 778 Red † 30-12-1983
94.45.02	MiG-21PFM	East German AF 779 Red
94.45.03	MiG-21PFM	East German AF 698 Red, '869 Red'
94.45.04	MiG-21PFM	East German AF 783 Red, Luftwaffe 22+31
94.45.05	MiG-21PFM	East German AF 765 Red
94.45.06	MiG-21PFM	East German AF 766 Red, East German AF 833 Red, Luftwaffe 22+32
94.45.07	MiG-21PFM	East German AF 767 Red † 2-8-1971
94.45.08	MiG-21PFM	East German AF 838 Red † 7-8-1967
94.45.09	MiG-21PFM	East German AF 770 Red
94.45.10	MiG-21PFM	East German AF 771 Red, Luftwaffe 22+29
94.46.06	MiG-21PFM	East German AF 762 Red
94.46.07	MiG-21PFM	East German AF 768 Red
94A.46.08	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4608 Black † 21-4-1988
94A.46.09	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 4609 Black
94.46.10	MiG-21PFM	East German AF 787 Red
94.46.11	MiG-21PFM	East German AF 793 Red
94.46.12	MiG-21PFM	East German AF 789 Red † 10-5-1973
94.46.13	MiG-21PFM	East German AF 791 Red
94.46.14	MiG-21PFM	East German AF 795 Red
94.46.15	MiG-21PFM	East German AF 796 Red
94.47.01	MiG-21PFM	East German AF 798 Red † 1-9-1981
94.47.02	MiG-21PFM	East German AF 808 Red † 26-6-1973
94.47.03	MiG-21PFM	East German AF 813 Red
94.47.04	MiG-21PFM	East German AF 819 Red
94.47.05	MiG-21PFM	East German AF 829 Red
94.47.06	MiG-21PFM	East German AF 836 Red
94A.47.07	MiG-21PFM (*izd.* 94A)	Romanian AF 4707
94A.47.08	MiG-21PFM (*izd.* 94A)	Romanian AF 4708 Red
94A.47.09	MiG-21PFM (*izd.* 94A)	Romanian AF 4709 Red (1)
94A.47.10	MiG-21PFM (*izd.* 94A)	Romanian AF 4710 Red
94A.47.11	MiG-21PFM (*izd.* 94A)	Romanian AF 4711 Red
94A.47.12	MiG-21PFM (*izd.* 94A)	Romanian AF 4712 Red
94A.47.13	MiG-21PFM (*izd.* 94A)	Romanian AF 4713 Red
94A.47.14	MiG-21PFM (*izd.* 94A)	Romanian AF 4714 Red
94A.47.15	MiG-21PFM (*izd.* 94A)	Romanian AF 4715 Red
94A.48.01	MiG-21PFM (*izd.* 94A)	Romanian AF 4801 Red
94A.48.02	MiG-21PFM (*izd.* 94A)	Romanian AF 4802 Red
94A.48.03	MiG-21PFM (*izd.* 94A)	Romanian AF 4803 Red
94A.48.04	MiG-21PFM (*izd.* 94A)	Romanian AF 4804
94A.49.07	MiG-21PFM (*izd.* 94A)	Romanian AF 4907 Red
94A.49.09	MiG-21PFM (*izd.* 94A)	Polish AF 4909 Red
94A.49.10	MiG-21PFM (*izd.* 94A)	Polish AF 4910 Red
94A.49.11	MiG-21PFM (*izd.* 94A)	Polish AF 4911 Red
94A.49.12	MiG-21PFM (*izd.* 94A)	Polish AF 4912 Red
94A.49.13	MiG-21PFM (*izd.* 94A)	Polish AF 4913 Red
94A.49.14	MiG-21PFM (*izd.* 94A)	Polish AF 4914 Red
94A.49.15	MiG-21PFM (*izd.* 94A)	Polish AF 4915 Red
94A.50.01	MiG-21PFM (*izd.* 94A)	Polish AF 5001 Red
94A.50.02	MiG-21PFM (*izd.* 94A)	Polish AF 5002 Red
94A.50.03	MiG-21PFM (*izd.* 94A)	Polish AF 5003 Red
94A.50.04	MiG-21PFM (*izd.* 94A)	Polish AF 5004 Red
94A.50.05	MiG-21PFM (*izd.* 94A)	Polish AF 5005 Red
94.51.13	MiG-21PFM	East German AF 841 Red
94.51.14	MiG-21PFM	East German AF 847 Red
94.51.15	MiG-21PFM	East German AF 849 Red † 14-1-1975
94.52.01	MiG-21PFM	East German AF 852 Red † 9-9-1989
94.52.02	MiG-21PFM	East German AF 861 Red, Luftwaffe '22 33'
94.52.03	MiG-21PFM	East German AF 865 Red
94.52.04	MiG-21PFM	East German AF 869 Red, Luftwaffe 22+34
94.52.05	MiG-21PFM	East German AF 871 Red † 16-5-1969
94.52.06	MiG-21PFM	East German AF 878 Red, Luftwaffe 22+35
94.52.07	MiG-21PFM	East German AF 882 Red No. 1
94.52.08	MiG-21PFM	East German AF 884
94.52.09	MiG-21PFM	East German AF 889 Red, Luftwaffe 22+36
94.52.10	MiG-21PFM	East German AF 891 Red, Luftwaffe 22+37
94.52.11	MiG-21PFM	East German AF 894 Red
94A.52.12	MiG-21PFM (*izd.* 94A)	Polish AF 5212 Red
94A.52.13	MiG-21PFM (*izd.* 94A)	Polish AF 5213 Red
94A.52.14	MiG-21PFM (*izd.* 94A)	Polish AF 5214 Red
94A.53.07	MiG-21PFM (*izd.* 94A)	Polish AF 5307 Red
94A.53.08	MiG-21PFM (*izd.* 94A)	Polish AF 5308 Red
94A.53.09	MiG-21PFM (*izd.* 94A)	Polish AF 5309 Red
94A.53.10	MiG-21PFM (*izd.* 94A)	Polish AF 5310 Red † 31-8-1971
94A.53.11	MiG-21PFM (*izd.* 94A)	Polish AF 5311 Red
94A.53.12	MiG-21PFM (*izd.* 94A)	Polish AF 5312 Red
94A.53.13	MiG-21PFM (*izd.* 94A)	Polish AF 5313 Red
94A.53.14	MiG-21PFM (*izd.* 94A)	Polish AF 5314 Red
94A.53.15	MiG-21PFM (*izd.* 94A)	Polish AF 5315 Red
94A.54.01	MiG-21PFM (*izd.* 94A)	Polish AF 5401 Red
94A.54.02	MiG-21PFM (*izd.* 94A)	Polish AF 5402 Red † 29-9-1967
94A.54.03	MiG-21PFM (*izd.* 94A)	Polish AF 5403 Red
94A.54.04	MiG-21PFM (*izd.* 94A)	Polish AF 5404 Red
94A.54.05	MiG-21PFM (*izd.* 94A)	Polish AF 5405 Red
94A.54.06	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 5406 Black
94A.54.07	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 5407 Black
94A.54.08	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 5408 Black † 6-1-1972
94A.54.09	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 5409 Black
94A.54.10	MiG-21PFM (*izd.* 94A)	Czechoslovak/Slovak AF 5410 Black
94A.54.11	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 5411 Black
94.55.09	MiG-21PFM	East German AF 897 Red, Luftwaffe '22 38'
94.55.10	MiG-21PFM	East German AF 898 Red, Luftwaffe 22+39
94.55.11	MiG-21PFM	East German AF 919 Red, Luftwaffe 22+40, 'EGAF 804 Red'
94.55.12	MiG-21PFM	East German AF 924 Red † 21-9-1967
94.55.13	MiG-21PFM	East German AF 929 Red
94.55.14	MiG-21PFM	East German AF 932 Red † 7-12-1967
94.55.15	MiG-21PFM	East German AF 933 Red † 29-1-1976
94.56.01	MiG-21PFM	East German AF 935 Red † 8-3-1990
94.56.02	MiG-21PFM	East German AF 937 Red, Luftwaffe 22+41
94.56.03	MiG-21PFM	East German AF 938 Red
94.56.04	MiG-21PFM	East German AF 940 Red, Luftwaffe 22+42
94.56.05	MiG-21PFM	East German AF 943 Red
94.56.06	MiG-21PFM	East German AF 948 Red, Luftwaffe 22+43
94.56.07	MiG-21PFM	East German AF 949 Red
94A.56.08	MiG-21PFM (*izd.* 94A)	Polish AF 5608 Red
94A.56.09	MiG-21PFM (*izd.* 94A)	Polish AF 5609 Red
94A.56.10	MiG-21PFM (*izd.* 94A)	Polish AF 5610 Red
94A.56.11	MiG-21PFM (*izd.* 94A)	Polish AF 5611 Red † 31-8-1971
94A.56.12	MiG-21PFM (*izd.* 94A)	Polish AF 5612 Red
94A.56.13	MiG-21PFM (*izd.* 94A)	Polish AF 5613 Red
94A.56.14	MiG-21PFM (*izd.* 94A)	Polish AF 5614 Red † 20-11-1992
94A.56.15	MiG-21PFM (*izd.* 94A)	Polish AF 5615 Red
94A.57.01	MiG-21PFM (*izd.* 94A)	Polish AF 5701 Red
94A.57.02	MiG-21PFM (*izd.* 94A)	Polish AF 5702 Red
94A.57.03	MiG-21PFM (*izd.* 94A)	Polish AF 5703 Red
94A.57.04	MiG-21PFM (*izd.* 94A)	Polish AF 5704 Red
94A.57.05	MiG-21PFM (*izd.* 94A)	Polish AF 5705 Red
94A.58.09	MiG-21PFM (*izd.* 94A)	Romanian AF 5809
94A.58.10	MiG-21PFM (*izd.* 94A)	Romanian AF 5810
94A.58.11	MiG-21PFM (*izd.* 94A)	Romanian AF 5811 Red
94A.58.12	MiG-21PFM (*izd.* 94A)	Romanian AF 5812
94A.58.13	MiG-21PFM (*izd.* 94A)	Romanian AF 5813
94A.58.14	MiG-21PFM (*izd.* 94A)	Romanian AF 5814 Red
94A.58.15	MiG-21PFM (*izd.* 94A)	Romanian AF 5815 Red
94A.59.03	MiG-21PFM (*izd.* 94A)	Romanian AF 5903 Red

94A.59.04	MiG-21PFM (*izd.* 94A)	Romanian AF 5904 White outline
94A.59.06	MiG-21PFM (*izd.* 94A)	Romanian AF 5906
94A.59.07	MiG-21PFM (*izd.* 94A)	Romanian AF 5907
94A.59.08	MiG-21PFM (*izd.* 94A)	Romanian AF 5908 Red
94A.59.09	MiG-21PFM (*izd.* 94A)	Romanian AF 5909 Red
94A.59.10	MiG-21PFM (*izd.* 94A)	Romanian AF 5910 Red
94A.64.05	MiG-21PFM (*izd.* 94A)	Romanian AF 6405 Red
94.64.07	MiG-21PFM	East German AF 952 Red
94.64.08	MiG-21PFM	East German AF 953 Red, Luftwaffe 22+44, 'Soviet AF 353 White'
94.64.09	MiG-21PFM	East German AF 958 Red
94.64.10	MiG-21PFM	East German AF 963 Red, Luftwaffe 22+45
94.64.11	MiG-21PFM	East German AF 964 Red
94.64.12	MiG-21PFM	East German AF 965 Red
94.64.13	MiG-21PFM*	East German AF 966 Red † 6-6-1972
94.64.14	MiG-21PFM*	East German AF 967 Red, Luftwaffe 22+14
94.64.15	MiG-21PFM*	East German AF 968 Red
94.65.01	MiG-21PFM*	East German AF 969 Red
94.65.02	MiG-21PFM*	East German AF 970 Red † 10-2-1973
94.65.03	MiG-21PFM*	East German AF 959 Red
94.65.04	MiG-21PFM*	East German AF 972 Red † 20-7-1968
94.65.05	MiG-21PFM*	East German AF 979 Red
94.65.06	MiG-21PFM*	East German AF 980 Red, Luftwaffe 22+15
94A.65.07	MiG-21PFM (*izd.* 94A)	Polish AF 6507 Red No. 1
94A.65.08	MiG-21PFM (*izd.* 94A)	Polish AF 6508 Red
94A.65.09	MiG-21PFM (*izd.* 94A)	Polish AF 6509 Red No. 1
94A.65.10	MiG-21PFM (*izd.* 94A)	Polish AF 6510 Red No. 1
94A.65.11	MiG-21PFM (*izd.* 94A)	Polish AF 6511 Red
94A.65.12	MiG-21PFM (*izd.* 94A)	Polish AF 6512 Red
94A.65.13	MiG-21PFM (*izd.* 94A)	Polish AF 6513 Red No. 1
94A.65.14	MiG-21PFM (*izd.* 94A)	Polish AF 6514 Red † 23-5-1968
94A.65.15	MiG-21PFM (*izd.* 94A)	Polish AF 6515 Red No. 1
94A.66.01	MiG-21PFM (*izd.* 94A)	Polish AF 6601 Red
94A.66.02	MiG-21PFM (*izd.* 94A)	Polish AF 6602 Red † 25-2-1980
94A.66.03	MiG-21PFM (*izd.* 94A)	Polish AF 6603 Red
94A.66.04	MiG-21PFM (*izd.* 94A)	Polish AF 6604 Red
94A.66.05	MiG-21PFM (*izd.* 94A)	Polish AF 6605 Red
94A.66.06	MiG-21PFM (*izd.* 94A)	Polish AF 6606 Red
94A.66.07	MiG-21PFM (*izd.* 94A)	Polish AF 6607 Red
94A.66.08	MiG-21PFM (*izd.* 94A)	Polish AF 6608 Red
94A.66.09	MiG-21PFM (*izd.* 94A)	Polish AF 6609 Red
94A.66.10	MiG-21PFM (*izd.* 94A)	Polish AF 6610 Red
94A.66.11	MiG-21PFM (*izd.* 94A)	Polish AF 6611 Red
94A.66.12	MiG-21PFM (*izd.* 94A)	Polish AF 6612 Red
94A.66.13	MiG-21PFM (*izd.* 94A)	Polish AF 6613 Red
94A.66.14	MiG-21PFM (*izd.* 94A)	Polish AF 6614 Red
94A.66.15	MiG-21PFM (*izd.* 94A)	Polish AF 6615 Red
94A.67.01	MiG-21PFM (*izd.* 94A)	Polish AF 6701 Red
94.67.02	MiG-21PFM*	East German AF 404 Red, Luftwaffe 22+08
94.67.03	MiG-21PFM*	East German AF 429 Red, East German AF 711 Red No. 2, Luftwaffe 22+01
94.67.04	MiG-21PFM*	East German AF 981 Red
94.67.05	MiG-21PFM*	East German AF 982 Red, Luftwaffe 22+16
94.67.06	MiG-21PFM*	East German AF 431 Red No. 1 † 1-8-1973
94.67.07	MiG-21PFM*	East German AF 432 Red † 29-1-1969
94.67.08	MiG-21PFM*	East German AF 436 Red
94.67.09	MiG-21PFM*	East German AF 441 Red, Luftwaffe 22+02*
94.67.10	MiG-21PFM*	East German AF 443 Red
94.67.11	MiG-21PFM*	East German AF 446 Red † 23-3-1978
94.67.12	MiG-21PFM*	East German AF 449 Red
94.67.13	MiG-21PFM*	East German AF 983 Red, Luftwaffe 22+17
94.67.14	MiG-21PFM*	East German AF 984 Red † 1-9-1980
94.67.15	MiG-21PFM*	East German AF 986 Red
94.68.01	MiG-21PFM*	East German AF 987 Red
94.68.03	MiG-21PFM*	East German AF 988 Red, Luftwaffe 22+18
94.68.04	MiG-21PFM*	East German AF 989 Red, Luftwaffe 22+19
94.68.05	MiG-21PFM*	East German AF 990 Red † 16-12-1968
94.68.06	MiG-21PFM*	East German AF 992 Red
94.68.07	MiG-21PFM*	East German AF 462 Red
94.68.08	MiG-21PFM*	East German AF 463 Red, Luftwaffe 22+20
94.68.02	MiG-21PFM*	East German AF 465 Red † 15-8-1973
94.68.09	MiG-21PFM*	East German AF 998 Red † 14-5-1973
94.68.10	MiG-21PFM*	East German AF 999 Red † 27-4-1982
94A.69.08	MiG-21PFM (*izd.* 94A)	Polish AF 6908 Red
94A.69.09	MiG-21PFM (*izd.* 94A)	Polish AF 6909 Red
94A.69.10	MiG-21PFM (*izd.* 94A)	Polish AF 6910 Red
94A.69.11	MiG-21PFM (*izd.* 94A)	Polish AF 6911 Red
94A.69.12	MiG-21PFM (*izd.* 94A)	Polish AF 6912 Red † 18-9-1970
94A.69.13	MiG-21PFM (*izd.* 94A)	Polish AF 6913 Red
94A.69.14	MiG-21PFM (*izd.* 94A)	Polish AF 6914 Red
94A.69.15	MiG-21PFM (*izd.* 94A)	Polish AF 6915 Red
94A.70.01	MiG-21PFM (*izd.* 94A)	Polish AF 7001 Red
94A.70.02	MiG-21PFM (*izd.* 94A)	Polish AF 7002 Red
94.70.03	MiG-21PFM*	East German AF 466 Red, Luftwaffe 22+03
94.70.04	MiG-21PFM*	East German AF 469 Red † 28-7-1977
94.70.05	MiG-21PFM*	East German AF 472
94.70.06	MiG-21PFM*	East German AF 473 Red † 21-9-1971, 'Soviet AF 47', 'EGAF 473 Red'
94.70.07	MiG-21PFM*	East German AF 474 Red
94.70.08	MiG-21PFM*	East German AF 476 Red
94.70.09	MiG-21PFM*	East German AF 479 Red, Luftwaffe 22+09
94.70.10	MiG-21PFM*	East German AF 481 Red, Luftwaffe 22+10
94A.70.11	MiG-21PFM (*izd.* 94A)	Polish AF 7011 Red
94A.70.12	MiG-21PFM (*izd.* 94A)	Polish AF 7012 Red
94A.70.13	MiG-21PFM (*izd.* 94A)	Polish AF 7013 Red
94A.70.14	MiG-21PFM (*izd.* 94A)	Polish AF 7014 Red
94A.70.15	MiG-21PFM (*izd.* 94A)	Polish AF 7015 Red
94A.71.01	MiG-21PFM (*izd.* 94A)	Polish AF 7101 Red
94A.71.02	MiG-21PFM (*izd.* 94A)	Polish AF 7102 Red
94A.71.03	MiG-21PFM (*izd.* 94A)	Polish AF 7103 Red
94A.71.13	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 7113 Black
94A.71.14	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 7114 Black
94A.71.15	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 7115 Black † 28-5-1983
94A.72.01	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 7201 Black
94A.72.02	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 7202 Black
94A.72.03	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 7203 Black
94A.72.04	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 7204 Black
94A.72.05	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 7205 Black
94A.72.06	MiG-21PFM (*izd.* 94A)	Czechoslovak/Slovak AF 7206 Black
94A.72.07	MiG-21PFM (*izd.* 94A)	Czechoslovak/Slovak AF 7207 Black
94A.72.08	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 7208 Black
94A.72.09	MiG-21PFM (*izd.* 94A)	Czechoslovak AF 7209 Black
94.72.10	MiG-21PFM*	East German AF 484 Red, Luftwaffe 22+04*
94.72.11	MiG-21PFM*	East German AF 486 Red, Luftwaffe 22+11
94.72.12	MiG-21PFM*	East German AF 487 Red † 14-11-1974
94.72.13	MiG-21PFM*	East German AF 489 Red, Luftwaffe 22+05*
94.72.14	MiG-21PFM*	East German AF 492 Red, Luftwaffe 22+12
94.72.15	MiG-21PFM*	East German AF 545 Red, Luftwaffe 22+21, 'EGAF 545 Red'
94.73.01	MiG-21PFM*	East German AF 549 Red, East German AF 542 Red, East German AF 674 Red † 25-4-1984
94.73.02	MiG-21PFM*	East German AF 559 Red, East German AF 567 Red † 17-1-1978
94.73.03	MiG-21PFM*	East German AF 560 Red No. 1, Luftwaffe 22+06
94.73.04	MiG-21PFM*	East German AF 565 Red, Luftwaffe 22+13
94.73.05	MiG-21PFM*	East German AF 572 Red, Luftwaffe 22+07
94N.78.09	MiG-21PFM (*izd.* 94N)	Polish AF 7809 Red, N221GL
94N.78.10	MiG-21PFM (*izd.* 94N)	Polish AF 7810 Red No. 1
94N.78.11	MiG-21PFM (*izd.* 94N)	Polish AF 7811 Red
94N.78.12	MiG-21PFM (*izd.* 94N)	Polish AF 7812 Red
94N.78.13	MiG-21PFM (*izd.* 94N)	Polish AF 7813 Red
94N.78.14	MiG-21PFM (*izd.* 94N)	Polish AF 7814 Red
94N.78.15	MiG-21PFM (*izd.* 94N)	Polish AF 7815 Red
94N.79.01	MiG-21PFM (*izd.* 94N)	Polish AF 7901 Red
94N.79.02	MiG-21PFM (*izd.* 94N)	Polish AF 7902 Red
94N.79.03	MiG-21PFM (*izd.* 94N)	Polish AF 7903 Red
94N.79.04	MiG-21PFM (*izd.* 94N)	Polish AF 7904 Red
94N.79.05	MiG-21PFM (*izd.* 94N)	Polish AF 7905 Red

94A.79.06		MiG-21PFM (*izd.* 94A)	Czechoslovak AF 7906 Black † 15-2-1972
94A.79.07		MiG-21PFM (*izd.* 94A)	Czechoslovak AF 7907 Black
94A.79.08		MiG-21PFM (*izd.* 94A)	Czechoslovak/Slovak AF 7908 Black
94N.79.09		MiG-21PFM (*izd.* 94N)	Czechoslovak AF 7909 Black
94N.79.10		MiG-21PFM (*izd.* 94N)	Czechoslovak/Slovak AF 7910 Black
94N.79.11		MiG-21PFM (*izd.* 94N)	Czechoslovak AF 7911 Black † 11-4-1984
94N.79.12		MiG-21PFM (*izd.* 94N)	Czechoslovak AF 7912 Black
94N.79.13		MiG-21PFM (*izd.* 94N)	Czechoslovak/Slovak AF 7913 Black
94N.79.14		MiG-21PFM (*izd.* 94N)	Czechoslovak AF 7914 Black
94N.79.15		MiG-21PFM (*izd.* 94N)	Czechoslovak AF 7915 Black † 16-3-1970
94N.80.01		MiG-21PFM (*izd.* 94N)	Czechoslovak AF 8001 Black
94N.80.02		MiG-21PFM (*izd.* 94N)	Czechoslovak AF 8002 Black
94N.80.03		MiG-21PFM (*izd.* 94N)	Romanian AF 8003 Red
94N.80.04		MiG-21PFM (*izd.* 94N)	Romanian AF 8004 Red
94N.80.05		MiG-21PFM (*izd.* 94N)	Romanian AF 8005 Red
94N.80.06		MiG-21PFM (*izd.* 94N)	Romanian AF 8006 White
94N.80.07		MiG-21PFM (*izd.* 94N)	Romanian AF 8007 Red
94N.80.08		MiG-21PFM (*izd.* 94N)	Romanian AF 8008 Red
94N.80.09		MiG-21PFM (*izd.* 94N)	Romanian AF 8009
94N.80.10		MiG-21PFM (*izd.* 94N)	Romanian AF 8010
94N.80.11		MiG-21PFM (*izd.* 94N)	Romanian AF 8011
94N.80.12		MiG-21PFM (*izd.* 94N)	Romanian AF 8012 Red
94N.80.13		MiG-21PFM (*izd.* 94N)	Romanian AF 8013
94N.80.14		MiG-21PFM (*izd.* 94N)	Romanian AF 8014
94N.80.15		MiG-21PFM (*izd.* 94N)	Romanian AF 8015 Red
94N.81.01		MiG-21PFM (*izd.* 94N)	Romanian AF 8101
94N.81.02		MiG-21PFM (*izd.* 94N)	Romanian AF 8102 Red No. 1
94N.81.03		MiG-21PFM (*izd.* 94N)	Romanian AF 8103 Red No. 1
94N.81.04		MiG-21PFM (*izd.* 94N)	Romanian AF 8104 No. 1
94N.81.05		MiG-21PFM (*izd.* 94N)	Romanian AF 8105 Red No. 1
94N.81.06		MiG-21PFM (*izd.* 94N)	Romanian AF 8106 No. 1
94N.81.07		MiG-21PFM (*izd.* 94N)	Romanian AF 8107 No. 1
94N.81.08		MiG-21PFM (*izd.* 94N)	Romanian AF 8108 Red
94N.81.09		MiG-21PFM (*izd.* 94N)	Romanian AF 8109
94N.81.10		MiG-21PFM (*izd.* 94N)	Romanian AF 8110 Red
94.84.07		MiG-21PFM	Yugoslav AF 22735
94.86.01		MiG-21PFM (*izd.* 94A)	Vietnamese People's AF 5020 Red
03.01.01		MiG-21R	not known (Soviet AF)
030AT22	1622	MiG-21R	Soviet AF '30 Red'
94R.0.14.20		MiG-21R	Bulgarian AF '130'
94R.0.14.21		MiG-21R	Bulgarian AF '231'
94R.0.14.22		MiG-21R	Polish AF 1422 Red
94R.0.14.23		MiG-21R	Polish AF 1423 Red
94R.0.15.01		MiG-21R	Czechoslovak/Czech AF 1501 Black
94R.0.15.02		MiG-21R	Czechoslovak/Slovak AF 1502 Black
94R.0.15.03		MiG-21R	Romanian AF 1503 Red
94R.0.15.04		MiG-21R	Romanian AF 1504 Red
94R.0.16.24		MiG-21R	Czechoslovak AF 1624 Black † 21-9-1971
94R.0.16.25		MiG-21R	Czechoslovak/Czech AF 1625 Black
94R.0.17.01		MiG-21R	Czechoslovak/Czech AF 1701 Black
94R.0.17.02		MiG-21R	Czechoslovak/Slovak AF 1702 Black
94R.0.17.03		MiG-21R	Czechoslovak/Slovak AF 1703 Black
94R.0.17.04		MiG-21R	Czechoslovak/Czech AF 1704 Black
94R.0.17.05		MiG-21R	Polish AF 1705 Red
94R.0.17.06		MiG-21R	Polish AF 1706 Red
94R.17.09		MiG-21R	Yugoslav/Serbian AF 26105
94R.0.17.13		MiG-21R	Bulgarian AF '223'
94R.0.17.14		MiG-21R	Bulgarian AF '224'
94R.0.17.15		MiG-21R	Bulgarian AF '325'
94R.0.17.16		MiG-21R	Bulgarian AF '326 White'
94R.0.18.24		MiG-21R	Czechoslovak/Czech AF 1824
94R.0.19.03		MiG-21R	Czechoslovak/Czech AF 1903 Black, 'SovAF 45'
94R.0.19.04		MiG-21R	Czechoslovak/Czech AF 1904 Black, N7803Z
94R.0.19.07		MiG-21R	Romanian AF 1907 Red
94R.0.19.08		MiG-21R	Romanian AF 1908 Red
94R.0.19.09		MiG-21R	Polish AF 1909 Red
94R.0.19.10		MiG-21R	Romanian AF 1910 Red
94R.0.19.11		MiG-21R	Polish AF 1911 Red
94R.0.19.12		MiG-21R	Polish AF 1912 Red
94R.0.19.13		MiG-21R	Polish AF 1913 Red
94R.0.19.14		MiG-21R	Polish AF 1914 Red
94R.0.19.15		MiG-21R	Polish AF 1915 Red
94R.0.19.16		MiG-21R	Polish AF 1916 Red
94R.0.19.17		MiG-21R	Polish AF 1917 Red
94R.0.19.18		MiG-21R	Czechoslovak/Slovak AF 1918
94R.0.19.19		MiG-21R	Czechoslovak AF 1919 Black † 21-7-1972
94R.0.19.20		MiG-21R	Czechoslovak/Slovak AF 1920
94R.0.19.21		MiG-21R	Czechoslovak AF 1921 Black † 1-7-1976
94R.0.19.22		MiG-21R	Czechoslovak/Slovak AF 1922
94R.0.19.23		MiG-21R	Czechoslovak/Slovak AF 1923 Black
94R.0.19.24		MiG-21R	Czechoslovak/Slovak AF 1924
94R.20.003	?	MiG-21R	Romanian AF 2003 Red
94R.20.007	?	MiG-21R	Romanian AF 2007 Red
94R.20.011	?	MiG-21R	Romanian AF 2011 Red
94R.20.017	?	MiG-21R	Romanian AF 2017 Red
94R.20.023	?	MiG-21R	Romanian AF 2023 Red
94R.0.20.066	?	MiG-21R	Czechoslovak/Czech AF 2066 Black, N80634
94R.0.20.083	?	MiG-21R	Czechoslovak AF 2083 Black † 18-8-1975
94R.20.403	?	MiG-21R	Romanian AF 2043 Red
94R.0.21.001	?	MiG-21R	Czechoslovak/Czech AF 2101 Black
94R.0.21.009	?	MiG-21R	Czechoslovak/Czech AF 2109 Black, 'SovAF 15'
94R.0.21.033	?	MiG-21R	Czechoslovak/Czech AF 2133 Black, N80639
94R.0.21.049	?	MiG-21R	Czechoslovak/Czech AF 2149 Black
94R.0.21.058	?	MiG-21R	Czechoslovak AF 2058 Black † 8-11-1973
94R.0.21.064	?	MiG-21R	Polish AF 1064 Red
94R.0.21.071	?	MiG-21R	Polish AF 1071 Red
94R.0.21.085	?	MiG-21R	Polish AF 1085 Red
94R.0.21.101	?	MiG-21R	Polish AF 1101 Red
94R.0.21.125	?	MiG-21R	Polish AF 1125 Red
94R.0.21.139	?	MiG-21R	Polish AF 1139 Red
94R.0.21.273	?	MiG-21R	Polish AF 1273 Red
94R.0.21.311	?	MiG-21R	Polish AF 1311 Red
94R.0.21.375	?	MiG-21R	Polish AF 1375 Red
94R.0.21.412	?	MiG-21R	Polish AF 1412 Red
94R.0.21.507	?	MiG-21R	Polish AF 1507 Red
94R.0.22.051	?	MiG-21R	Polish AF 2051 Red
94R.0.22.089	?	MiG-21R	Polish AF 2089 Red
94R.0.22.097	?	MiG-21R	Polish AF 2097 Red
94R.0.22.111	?	MiG-21R	Polish AF 2111 Red
94R.0.22.213	?	MiG-21R	Polish AF 2213 Red
94R.0.22.301	?	MiG-21R	Polish AF 2301 Red
94R.0.22.355	?	MiG-21R	Polish AF 2355 Red
94R.0.22.402	?	MiG-21R	Polish AF 2402 Red
94R.0.22.426	?	MiG-21R	Polish AF 2426 Red
94R.0.22.503	?	MiG-21R	Polish AF 2503 Red
94R.0.22.533	?	MiG-21R	Polish AF 2533 Red
94R.0.22.617	?	MiG-21R	Polish AF 2617 Red
94R.0.22.657	?	MiG-21R	Polish AF 2657 Red
N95.21.01.01		MiG-21S	not known (Soviet AF)
N95.21.01.02		MiG-21S	Soviet AF '92 Red', '93 Red'
N950SCh13	0713	MiG-21S	not known (Soviet AF)
N950 SI 13	0813	MiG-21S	Soviet AF '20 Red'?
150 SO 01	0301	MiG-21SM	Soviet AF '35 White outline'
96.03.07		MiG-21M	East German AF 508 Red, Luftwaffe 22+63
96.03.08		MiG-21M	East German AF 515 Red, Luftwaffe 22+64
96.03.09		MiG-21M	East German AF 517 Red, Luftwaffe 22+78
96.03.10		MiG-21M	East German AF 523 Red † 22-9-1978
96.04.01		MiG-21M	East German AF 526 Red, Luftwaffe 22+65
96.04.02		MiG-21M	East German AF 531 Red, Luftwaffe 22+91
96.04.03		MiG-21M	East German AF 532 Red, not known (Syrian AF)
96.04.04		MiG-21M	East German AF 541 Red, Luftwaffe 22+67

96.04.05	MiG-21M	East German AF 549 Red, Luftwaffe 22+69
96.04.06	MiG-21M	East German AF 552 Red, Luftwaffe 22+79
96.04.07	MiG-21M	East German AF 553 Red, Luftwaffe 22+80
96.04.08	MiG-21M	East German AF 555 Red † 26-10-1971
96.04.09	MiG-21M	East German AF 559 Red, Luftwaffe 22+81
96.04.10	MiG-21M	East German AF 560 Red No. 2 † 10-1-1974
96.05.01	MiG-21M	East German AF 561 Red, Luftwaffe 22+70
96.05.02	MiG-21M	East German AF 562 Red, Luftwaffe 22+82
96.05.05	MiG-21M	East German AF 568 Red, East German AF 571 Red, Luftwaffe 22+83
96.05.03	MiG-21M	East German AF 570 Red, Luftwaffe 22+72
96.05.04	MiG-21M	East German AF 575 Red, Luftwaffe 22+74
96.05.06	MiG-21M	East German AF 578 Red, Luftwaffe 22+75
96.05.07	MiG-21M	East German AF 579 Red, '5794 Red', Luftwaffe 22+84
96.05.08	MiG-21M	East German AF 581 Red, Luftwaffe 22+85, EGAF '581 Red'
96.05.09	MiG-21M	East German AF 582 Red, Syrian AF 7603
96.05.10	MiG-21M	East German AF 583 Red, Luftwaffe 22+92
96.05.11	MiG-21M	East German AF 586 Red † 1-10-1976
96.05.12	MiG-21M	East German AF 587 Red, Luftwaffe 22+93
96.05.13	MiG-21M	East German AF 588 Red, Luftwaffe 22+86
96.05.14	MiG-21M	East German AF 589 Red, Luftwaffe 22+87
96.05.15	MiG-21M	East German AF 590 Red † 16-3-1985
96.06.01	MiG-21M	East German AF 592 Red † 8-6-1970
96.06.02	MiG-21M	East German AF 594 Red, Luftwaffe 22+94
96.06.08	MiG-21M	Bulgarian AF '108 White'
96.06.09	MiG-21M	Bulgarian AF '209'
96.06.10	MiG-21M	Bulgarian AF '310'
96.06.11	MiG-21M	Bulgarian AF '411'
96.06.12	MiG-21M	Bulgarian AF '512' † 3-11-1971
96.06.13	MiG-21M	Bulgarian AF '613 White'
96.06.14	MiG-21M	Bulgarian AF '714' † 26-8-1974
96.06.15	MiG-21M	Bulgarian AF '815' † 17-9-80
96.07.01	MiG-21M	Bulgarian AF '101' † 21-6-1977
96.07.02	MiG-21M	Bulgarian AF '202 White'
96.07.03	MiG-21M	Bulgarian AF '303'
96.07.04	MiG-21M	Bulgarian AF '404' † 17-6-1984
96.07.05	MiG-21M	East German AF 597 Red, Luftwaffe 22+96
96.07.06	MiG-21M	East German AF 602 Red, Luftwaffe 22+88
96.07.07	MiG-21M	East German AF 603 Red, Luftwaffe 22+97
96.07.08	MiG-21M	East German AF 596 Red, '596 Black'
96.07.09	MiG-21M	East German AF 607 Red † 24-3-1972
96.07.11	MiG-21M	East German AF 609 Red, Luftwaffe 22+98
96.07.10	MiG-21M	East German AF 610 Red, not known (Syrian AF)
96.07.12	MiG-21M	East German AF 614 Red, Luftwaffe 22+99
96.07.13	MiG-21M	East German AF 616 Red, Luftwaffe 23+01
96.07.14	MiG-21M	East German AF 617 Red † 10-5-1973
96.07.15	MiG-21M	East German AF 621 Red, Luftwaffe 23+02
96.08.01	MiG-21M	East German AF 595 Red, Luftwaffe 22+95
96.11.11	MiG-21M	East German AF 611 Red, Luftwaffe '22 89'
96.11.12	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 1112 Black
96.11.13	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 1113 Black
96.11.14	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 1114 Black
96.11.15	MiG-21M	Czechoslovak AF 1115 Black † 26-3-1973
96.12.01	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 1201 Black
96.12.02	MiG-21M	Czechoslovak AF 1202 Black † 8-11-1982
96.12.03	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 1203 Black
96.12.04	MiG-21M	Czechoslovak AF 1204 Black † 12-8-1970
96.12.05	MiG-21M	Czechoslovak/Czech AF 1205 Black † 22-4-1991
96.12.06	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 1206 Black
96.12.07	MiG-21M	Czechoslovak/Czech AF 1207 Black
96.12.08	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 1208 Black
96.12.09	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 1209 Black
96.12.10	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 1210 Black
96.12.11	MiG-21M, Lancer A*	Romanian AF 211 Red, 211 Black*
96.12.12	MiG-21M, Lancer A*	Romanian AF 212 Red, 212 Black*
96.12.13	MiG-21M, Lancer A*	Romanian AF 213 Red, 213 Black*
96.12.14	MiG-21M	Romanian AF 214 Red
96.12.15	MiG-21M, Lancer A*	Romanian AF 215 Red, 215 Black*
96.13.01	MiG-21M, Lancer A*	Romanian AF 301 Red, 301 Black*
96.13.02	MiG-21M	Romanian AF 302 Red
96.13.03	MiG-21M	Romanian AF 303 Red
96.13.04	MiG-21M, Lancer A*	Romanian AF 304 Red, 304 Black*
96.13.05	MiG-21M, Lancer A*	Romanian AF 305 Red, 305 Black*
96.13.06	MiG-21M	Romanian AF 306 Red
96.13.07	MiG-21M	Romanian AF 307 Red
96.13.08	MiG-21M	Romanian AF 308 Red
96.15.03	MiG-21M	Romanian AF 503 Red
96.15.04	MiG-21M	Romanian AF 504 Red
96.15.05	MiG-21M	Romanian AF 505 Red
96.15.06	MiG-21M, Lancer A*	Romanian AF 506 Red, 506 Black*
96.15.07	MiG-21M	Romanian AF 507 Red
96.18.07	MiG-21M	Polish AF 1807 Red
96.18.08	MiG-21M	Polish AF 1808 Red, 'Polish AF 04 Red'
96.18.09	MiG-21M	Polish AF 1809 Red
96.18.10	MiG-21M	Polish AF 1810 Red
96.18.11	MiG-21M	Polish AF 1811 Red
96.18.12	MiG-21M	Polish AF 1812 Red
96.18.13	MiG-21M	Polish AF 1813 Red
96.18.14	MiG-21M	Polish AF 1814 Red
96.18.15	MiG-21M	Polish AF 1815 Red † 3-9-1970
96.19.01	MiG-21M	Polish AF 1901 Red
96.19.02	MiG-21M	Polish AF 1902 Red † 17-11-1982
96.19.03	MiG-21M	Polish AF 1903 Red
96.19.04	MiG-21M	Polish AF 1904 Red
96.1905	MiG-21M	Polish AF 1905 Red
96.19.06	MiG-21M	Polish AF 1906 Red
96.19.07	MiG-21M	Polish AF 1907 Red
96.19.08	MiG-21M	Polish AF 1908 Red † 30-7-1978
96.19.09	MiG-21M	Polish AF 1909 Red
96.19.10	MiG-21M	Polish AF 1910 Red
96.19.11	MiG-21M	Polish AF 1911 Red
96.19.12	MiG-21M	Polish AF 1912 Red
96.19.13	MiG-21M	Polish AF 1913 Red
96.19.14	MiG-21M	Polish AF 1914 Red
96.19.15	MiG-21M	Polish AF 1915 Red
96.20.02	MiG-21M	Polish AF 2002 Red
96.20.02	MiG-21M	Polish AF 2002 Red † 31-12-1975
96.20.03	MiG-21M	Polish AF 2003 Red
96.20.04	MiG-21M	Polish AF 2004 Red
96.20.05	MiG-21M	Polish AF 2005 Red
96.20.06	MiG-21M	Polish AF 2006 Red
96.20.07	MiG-21M	Polish AF 2007 Red
96.20.08	MiG-21M	Polish AF 2008 Red
96.20.09	MiG-21M	Polish AF 2009 Red No. 2
96.20.10	MiG-21M	Polish AF 2010 Red
96.20.11	MiG-21M	Polish AF 2011 Red † 20-6-1979
96.20.12	MiG-21M	Polish AF 2012 Red
96.20.13	MiG-21M	East German AF 401 Red † 11-9-1970
96.20.14	MiG-21M	East German AF 402 Red, not known (Syrian AF)
96.20.15	MiG-21M	East German AF 403 Red, not known (Syrian AF)
96.21.01	MiG-21M	East German AF 406 Red, Syrian AF 7602
96.21.02	MiG-21M	East German AF 407 Red, not known (Syrian AF)
96.21.03	MiG-21M	East German AF 408 Red † 28-12-1978
96.21.04	MiG-21M	East German AF 410 Red, Luftwaffe 22+46
96.21.05	MiG-21M	East German AF 412 Red, not known (Syrian AF)
96.21.06	MiG-21M	East German AF 413 Red, Luftwaffe 22+90
96.21.07	MiG-21M	East German AF 414 Red, not known (Syrian AF)
96.21.08	MiG-21M	East German AF 415 Red, Syrian AF 7601
96.21.09	MiG-21M	East German AF 417 Red † 20-9-1984
96.21.10	MiG-21M	East German AF 418 Red, not known (Syrian AF)
96.21.11	MiG-21M	East German AF 419 Red, Luftwaffe 22+47
96.23.08	MiG-21M	East German AF 425 Red, Luftwaffe 22+77
96.23.09	MiG-21M	Bulgarian AF '109'
96.23.10	MiG-21M	Bulgarian AF '210 White'
96.23.11	MiG-21M	Bulgarian AF '311'
96.26.13	MiG-21M	Czechoslovak AF 2613 Black † 15-4-1988

96.26.14	MiG-21M, MiG-21MA?	Czechoslovak/Czech AF 2614 Black
96.26.15	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 2615 Black
96.27.01	MiG-21M	Czechoslovak AF 2701 Black
96.27.02	MiG-21M	Czechoslovak AF 2702 Black † 2-4-1981
96.27.03	MiG-21M	Czechoslovak/Czech AF 2703 Black
96.27.04	MiG-21M	Czechoslovak/Czech AF 2704 Black
96.27.05	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 2705 Black
96.27.06	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 2706 Black
96.27.07	MiG-21M, MiG-21MA	Czechoslovak/Slovak AF 2707 Black
96.27.08	MiG-21M	Romanian AF 708 Red
96.27.09	MiG-21M	Romanian AF 709 Red
96.27.10	MiG-21M, Lancer A*	Romanian AF 710 Red, 710 Black*
96.27.11	MiG-21M, Lancer A*	Romanian AF 711 Red, 711 Black*
96.27.12	MiG-21M, Lancer A*	Romanian AF 712 Red, 712 Red
96.27.13	MiG-21M, Lancer A*	Romanian AF 713 Red, 713 Black*
96.27.14	MiG-21M, Lancer A*	Romanian AF 714 Red, 714 Black*
96.27.15	MiG-21M, Lancer A*	Romanian AF 715 Red, 715 Black*
96.28.01	MiG-21M, Lancer A*	Romanian AF 801 Red, 801 Black*
96.28.02	MiG-21M	Romanian AF 802 Red
96.28.03	MiG-21M, Lancer A*	Romanian AF 803 Red, 803 Black*
96.28.04	MiG-21M, Lancer A*	Romanian AF 804 Red, 804 Black*
96.28.05	MiG-21M	Romanian AF 805 Red
96.28.06	MiG-21M, Lancer A*	Romanian AF 806 Red, 806 Black*
96.28.07	MiG-21M	Romanian AF 807 Red
96.28.08	MiG-21M, Lancer A*	Romanian AF 808 Red, 808 Black*
96.28.09	MiG-21M	Romanian AF 809 Red
96.28.10	MiG-21M, Lancer A*	Romanian AF 810 Red, 810 Black*
96.28.11	MiG-21M, Lancer A*	Romanian AF 811 Red, 811 Black*
96.28.12	MiG-21M, Lancer A*	Romanian AF 812 Red, 812 Black*
96.28.13	MiG-21M	Romanian AF 813 Red
96.28.14	MiG-21M	Romanian AF 814 Red
96.28.15	MiG-21M, Lancer A*	Romanian AF 815 Red, 815 Black*
96.29.01	MiG-21M, Lancer A*	Romanian AF 901 Red, 901 Black*
96.29.02	MiG-21M, Lancer A*	Romanian AF 902 Red
96.29.03	MiG-21M	Romanian AF 903 Red, 903 Black*
96.29.04	MiG-21M, Lancer A*	Romanian AF 904 Red, 904 Black*
96.29.05	MiG-21M	Romanian AF 905 Red
96.29.06	MiG-21M, Lancer A*	Romanian AF 906 Red
96.29.07	MiG-21M, Lancer A*	Romanian AF 907 Red, 907 Black*
96.29.08	MiG-21M, Lancer A*	Romanian AF 908 Red, 908 Black*
96.29.09	MiG-21M	Romanian AF 909 Red
96.29.10	MiG-21M	Romanian AF 910 Red
96.29.11	MiG-21M, Lancer A*	Romanian AF 911 Red
96.29.12	MiG-21M	Romanian AF 912 Red
96.29.13	MiG-21M, Lancer A*	Romanian AF 913 Red
96.29.14	MiG-21M	Romanian AF 914 Red
96.29.15	MiG-21M	Romanian AF 915 Red
96.30.01	MiG-21M, Lancer A*	Romanian AF 3001 Red, 3001 Black*
96.30.02	MiG-21M, Lancer A*	Romanian AF 3002 Red, 3002 Black*
96.30.03	MiG-21M, Lancer A*	Romanian AF 3003 Red, 3003 Black*
96.30.07	MiG-21M	Yugoslav AF 22805
96.31.15	MiG-21M	Yugoslav AF 22818
96.32.04	MiG-21M	East German AF 428 Red, Luftwaffe 22+48
96.32.05	MiG-21M	East German AF 430 Red, East German AF 431 Red No. 2, Luftwaffe 22+49
96.32.06	MiG-21M	East German AF 432 Red, Luftwaffe 22+50
96.32.07	MiG-21M	East German AF 435 Red, Luftwaffe 22+51
96.32.09	MiG-21M	East German AF 438 Red, Luftwaffe 22+52
96.32.10	MiG-21M	East German AF 445 Red, Luftwaffe 22+53
96.32.11	MiG-21M	East German AF 465 Red, Luftwaffe 22+55
96.32.12	MiG-21M	East German AF 461 Red, Luftwaffe 22+54
96.32.13	MiG-21M	East German AF 464 Red † 31-12-74
96.32.14	MiG-21M	East German AF 468 Red, Luftwaffe 22+56
96.32.15	MiG-21M	East German AF 483 Red, Luftwaffe 22+57
96.33.01	MiG-21M	East German AF 491 Red, Luftwaffe 22+58
96.33.02	MiG-21M	East German AF 493 Red, Luftwaffe 22+59*
96.33.03	MiG-21M	East German AF 497 Red, Luftwaffe 22+60
96.33.04	MiG-21M	East German AF 498 Red † 7-8-1973
96.33.05	MiG-21M	East German AF 499 Red, Luftwaffe 22+61
96.33.06	MiG-21M	East German AF 502 Red † 13-4-1971
96.33.07	MiG-21M	East German AF 505 Red, Luftwaffe 22+62
96.33.08	MiG-21M	East German AF 507 Red † 7-8-1973
96.33.09	MiG-21M	East German AF 520 Red † 31-8-1974
96.33.10	MiG-21M	East German AF 527 Red, Luftwaffe 22+66
96.33.11	MiG-21M	East German AF 542 Red, Luftwaffe 22+68
96.33.12	MiG-21M	East German AF 565 Red † 23-7-1971
96.33.13	MiG-21M	East German AF 566 Red, Luftwaffe 22+71
96.33.14	MiG-21M	East German AF 573 Red, Luftwaffe 22+73
96.33.15	MiG-21M	East German AF 580 Red, Luftwaffe 22+76
96.34.01	MiG-21M	East German AF 585 Red † 28-8-1974
96.38.11	MiG-21M	Algerian AF FD-26
96.40.01	MiG-21MT	not known (Soviet AF)
96.40.02	MiG-21MT	not known (Soviet AF)
96.40.03	MiG-21MT	not known (Soviet AF)
96.40.04	MiG-21MT	not known (Soviet AF)
96.40.05	MiG-21MT	not known (Soviet AF)
96.40.06	MiG-21MT	not known (Soviet AF)
96.40.07	MiG-21MT	not known (Soviet AF)
96.40.08	MiG-21MT	not known (Soviet AF)
96.40.09	MiG-21MT	not known (Soviet AF)
96.40.10	MiG-21MT	not known (Soviet AF)
96.40.11	MiG-21MT	Soviet AF '11 Blue'
96.40.12	MiG-21MT	not known (Soviet AF)
96.40.13	MiG-21MT	not known (Soviet AF)
96.40.14	MiG-21MT	Soviet AF '14 White outline'
96.40.15	MiG-21MT	Soviet AF '15 Black outline'
96.43.06	MiG-21MF	17-7-71 Czechoslovak AF 4306 Black † 10-5-1985
96.43.07	MiG-21MF	17-7-71? Czechoslovak/Czech AF 4307 Black No. 1
96.43.08	MiG-21MF	19-7-71 Czechoslovak/Slovak AF 4308 Black
96.43.09	MiG-21MF	23-6-71 Czechoslovak/Slovak AF 4309 Black
96.43.10	MiG-21MF	4-7-71 Czechoslovak/Slovak AF 4310 Black
96.43.11	MiG-21MF	25-5-71 Czechoslovak/Slovak AF 4311 Black
96.43.12	MiG-21MF	24-6-71 Czechoslovak/Slovak AF 4312 Black
96.43.13	MiG-21MF	24-6-71 Czechoslovak/Slovak AF 4313 Black
96.43.14	MiG-21MF	7-1971 Czechoslovak AF 4314 Black † 15-10-1975
96.43.15	MiG-21MF	7-1971 Czechoslovak/Czech AF 4315 Black † 10-6-1992
96.44.01	MiG-21MF	24-6-71 Czechoslovak/Slovak AF 4401 Black
96.44.02	MiG-21MF	24-6-71 Czechoslovak/Slovak AF 4402 Black
96.44.03	MiG-21MF	Hungarian AF 4403 Red
96.44.04	MiG-21MF	Hungarian AF 4404 Red
96.44.05	MiG-21MF	Hungarian AF 4405 Red
96.44.06	MiG-21MF	Hungarian AF 4406 Red
96.44.07	MiG-21MF	Hungarian AF 4407 Red
96.44.08	MiG-21MF	Hungarian AF 4408 Red
96.44.09	MiG-21MF	Hungarian AF 4409 Red
96.44.11	MiG-21MF	?? Blue (Soviet AF)
96.46.02	MiG-21MF	Hungarian AF 4602 Red † 27-6-1978 (5-6-1984?)
96.46.03	MiG-21MF	Hungarian AF 4603 Red
96.46.04	MiG-21MF	Hungarian AF 4604 Red † 27-6-1978
96.46.05	MiG-21MF	Hungarian AF 4605 Red
96.46.06	MiG-21MF	Hungarian AF 4606 Red
96.46.07	MiG-21MF	Hungarian AF 4607 Red
96.46.08	MiG-21MF	Hungarian AF 4608 Red
96.47.02	MiG-21MF	not known (Algerian AF)
96.47.12	MiG-21MF	Algerian AF FD-16
96.48.06	MiG-21MF	Yugoslav/Serbian AF 22823
96.52.09	MiG-21MF	2-3-72 Czechoslovak/Czech AF 5209 Black † 17-6-1999
96.52.10	MiG-21MF	3-2-72 Czechoslovak/Czech AF 5210 Black
96.52.11	MiG-21MF	Czechoslovak/Czech AF 5211 Black † 16-8-1972 (28-8-1972?)
96.52.12	MiG-21MF	4-2-72 Czechoslovak/Czech AF 5212 Black
96.52.13	MiG-21MF	5-2-72 Czechoslovak/Czech AF 5213 Black
96.52.14	MiG-21MF	10-2-72 Czechoslovak/Czech AF 5214 Black
96.52.15	MiG-21MF	16-2-72 Czechoslovak/Czech AF 5215 Black † 2-9-1996
96.53.01	MiG-21MF	19-2-72 Czechoslovak/Czech AF 5301 Black
96.53.02	MiG-21MF	24-2-72 Czechoslovak/Czech AF 5302 Black

96.53.03	MiG-21MF	18-2-72	Czechoslovak/Czech AF 5303 Black
96.53.04	MiG-21MF	24-2-72	Czechoslovak/Czech AF 5304 Black
96.53.05	MiG-21MF	22-2-72	Czechoslovak/Czech AF 5305 Black
96.53.06	MiG-21MF		East German AF 649 Red, Luftwaffe 23+23
96.53.07	MiG-21MF		East German AF 650 Red, Luftwaffe 23+24
96.53.08	MiG-21MF		East German AF 651 Red, Luftwaffe 23+25
96.53.09	MiG-21MF		East German AF 656 Red † 23-6-1973
96.53.10	MiG-21MF		East German AF 652 Red, Luftwaffe 23+26
96.53.11	MiG-21MF		East German AF 653 Red
96.53.12	MiG-21MF		East German AF 654 Red † 23-6-1973
96.53.13	MiG-21MF		East German AF 657 Red, Luftwaffe 23+27
96.53.14	MiG-21MF		East German AF 658 Red, Luftwaffe 23+38
96.53.15	MiG-21MF		East German AF 659 Red, Luftwaffe 23+28
96.54.01	MiG-21MF		East German AF 660 Red, Luftwaffe 23+29
96.54.02	MiG-21MF		East German AF 662 Red, Luftwaffe 23+30
96.54.03	MiG-21MF		East German AF 664 Red, Luftwaffe 23+31
96.54.04	MiG-21MF		East German AF 665 Red, Luftwaffe 23+32
96.59.07	MiG-21MF, Lancer A*		Romanian AF 5907 Red, 5907 Black* † 23-10-2002
96.59.08	MiG-21MF, Lancer A*		Romanian AF 5908 Red, 5908 Black*
96.59.10	MiG-21MF, Lancer A*		Romanian AF 5910 Red, 5910 Black*
96.59.11	MiG-21MF, Lancer A*		Romanian AF 5911 Red, 5911 Black*
96.59.12	MiG-21MF, Lancer A*		Romanian AF 5912 Red, 5912 Black*
96.59.13	MiG-21MF, Lancer A*		Romanian AF 5913 Red, 5913 Black*
96.59.14	MiG-21MF		Romanian AF 5914 Red
96.59.15	MiG-21MF, Lancer A*		Romanian AF 5915 Red, 5915 Black*
96.60.01	MiG-21MF, Lancer A*		Romanian AF 6001 Red, 6001 Black* † 21-2-2002
96.60.02	MiG-21MF, Lancer C*		Romanian AF 6002 Red, 6002 Black*
96.60.03	MiG-21MF, Lancer A*		Romanian AF 6003 Red, 6003 Black*
96.62.05	MiG-21MF		East German AF 667 Red, Luftwaffe 23+33
96.62.06	MiG-21MF		East German AF 670 Red
96.62.07	MiG-21MF		East German AF 673 Red
96.62.08	MiG-21MF		East German AF 674 † 30-8-1973
96.62.09	MiG-21MF		East German AF 675 Red, Luftwaffe 23+34
96.62.10	MiG-21MF		East German AF 680 Red, Luftwaffe 23+35
96.62.11	MiG-21MF		East German AF 681 Red, Luftwaffe 23+39
96.62.12	MiG-21MF		East German AF 682 Red † 6-9-1976
96.62.13	MiG-21MF		East German AF 683 Red, Luftwaffe 23+36
96.62.14	MiG-21MF		East German AF 685 Red, Luftwaffe 23+37
96.62.15	MiG-21MF		East German AF 687 Red, Luftwaffe '23 40', EGAF '687 Red'
96.63.01	MiG-21MF		East German AF 686
96.65.03	MiG-21MF		Polish AF 6503 Red
96.65.04	MiG-21MF		Polish AF 6504 Red
96.65.05	MiG-21MF		Polish AF 6505 Red
96.65.06	MiG-21MF		Polish AF 6506 Red
96.65.07	MiG-21MF		Polish AF 6507 Red
96.65.08	MiG-21MF		Polish AF 6508 Red
96.65.09	MiG-21MF		Polish AF 6509 Red
96.65.10	MiG-21MF		Polish AF 6510 Red
96.65.11	MiG-21MF		Polish AF 6511 Red † 27-7-71
96.65.12	MiG-21MF		Polish AF 6512 Red
96.65.13	MiG-21MF		Polish AF 6513 Red
96.65.14	MiG-21MF		Polish AF 6514 Red
96.65.15	MiG-21MF		Polish AF 6515 Red
96.66.01	MiG-21MF		Polish AF 6601 Red
96.66.02	MiG-21MF		Polish AF 6602 Red
96.66.03	MiG-21MF		Polish AF 6603 Red
96.66.04	MiG-21MF		Polish AF 6604 Red
96.67.15	MiG-21MF		Polish AF 6715 Red
96.68.04	MiG-21MF		Polish AF 6804 Red; 6804 White outline
96.68.08	MiG-21MF		Polish AF 6808 Red
96.68.10	MiG-21MF		Polish AF 6810 Red
96.68.12	MiG-21MF		Polish AF 6812 Red
96.68.13	MiG-21MF		Polish AF 6813 Red
96.68.14	MiG-21MF		Polish AF 6814 Red
96.72.01	MiG-21MF		Bangladesh AF 201
96.72.02	MiG-21MF		Bangladesh AF 202
96.72.03	MiG-21MF		Bangladesh AF 203
96.72.04	MiG-21MF		Bangladesh AF 204
96.72.05	MiG-21MF		Bangladesh AF 205
96.72.06	MiG-21MF		Bangladesh AF 206
96.72.07	MiG-21MF		Bangladesh AF 207 † 1982
96.72.08	MiG-21MF		Bangladesh AF 208
96.72.09	MiG-21MF		Bangladesh AF 209
96.72.10	MiG-21MF		Bangladesh AF 210
96.76.03	MiG-21MF		East German AF 427 Red, Luftwaffe 23+03
96.76.04	MiG-21MF		East German AF 430 Red, Luftwaffe 23+04
96.76.05	MiG-21MF		East German AF 437 Red, Luftwaffe 23+05
96.76.06	MiG-21MF		East German AF 447 Red † 17-8-1977
96.76.07	MiG-21MF		East German AF 448 Red, Luftwaffe 23+06; EGAF '7607 Red'?
96.76.08	MiG-21MF		East German AF 460 Red, Luftwaffe 23+07
96.76.09	MiG-21MF		East German AF 470 Red, Luftwaffe 23+09
96.76.10	MiG-21MF		East German AF 467 Red, Luftwaffe 23+08
96.76.11	MiG-21MF	20-6-73	Czechoslovak/Czech AF 7611 Black
96.76.12	MiG-21MF		East German AF 473 Red, Luftwaffe 23+10
96.76.13	MiG-21MF		East German AF 477 Red, Luftwaffe 23+11
96.76.14	MiG-21MF		East German AF 478 Red, Luftwaffe 23+12
96.76.15	MiG-21MF		East German AF 490 Red, Luftwaffe 23+13*
96.77.01	MiG-21MF	22-6-73	Czechoslovak/Czech AF 7701 Black, Czech AF 7701 Grey
96.77.02	MiG-21MF	13-6-73	Czechoslovak/Slovak AF 7702 Black
96.77.03	MiG-21MF	14-6-72	Czechoslovak/Slovak AF 7703 Black
96.77.04	MiG-21MF	11-6-72	Czechoslovak/Slovak AF 7704 Black
96.77.05	MiG-21MF	22-6-73	Czechoslovak/Czech AF 7705 Black
96.77.06	MiG-21MF	15-6-73	Czechoslovak/Slovak AF 7706 Black
96.77.07	MiG-21MF	15-6-73	Czechoslovak/Slovak AF 7707 Black
96.77.08	MiG-21MF	16-6-73	Czechoslovak/Slovak AF 7708 Black, N7708
96.77.09	MiG-21MF	?-6-73	Czechoslovak/Czech AF 7709 Black † 28-8-1992
96.77.10	MiG-21MF	18-6-73	Czechoslovak/Slovak AF 7710 Black
96.77.11	MiG-21MF	21-6-73	Czechoslovak/Czech AF 7711 Black † 8-6-1998
96.77.12	MiG-21MF	18-6-73	Czechoslovak/Slovak AF 7712 Black
96.77.13	MiG-21MF	28-6-73	Czechoslovak/Slovak AF 7713 Black
96.77.14	MiG-21MF	28-6-73	Czechoslovak/Slovak AF 7714 Black
96.77.15	MiG-21MF	28-6-73	Czechoslovak/Slovak AF 7715 Black
96.78.01	MiG-21MF	5-7-73	Czechoslovak/Slovak AF 7801 Black
96.78.02	MiG-21MF	30-6-73	Czechoslovak/Czech AF 7802 Black
96.78.03	MiG-21MF	5-7-73	Czechoslovak/Slovak AF 7803 Black
96.78.04	MiG-21MF	?-6/7-73	Czechoslovak AF 7804 Black † 17-1-1979
96.78.05	MiG-21MF		Polish AF 7805 Red
96.78.06	MiG-21MF		Polish AF 7806 Red
96.78.07	MiG-21MF		Polish AF 7807 Red
96.78.08	MiG-21MF		Polish AF 7808 Red † 31-12-1975
96.78.09	MiG-21MF		Polish AF 7809 Red; 7809 White outline
96.78.10	MiG-21MF		Polish AF 7810 Red
96.78.11	MiG-21MF		Polish AF 7811 Red
96.78.12	MiG-21MF		Polish AF 7812 Red
96.78.13	MiG-21MF		Polish AF 7813 Red † 12-8-1975
96.78.14	MiG-21MF		Polish AF 7814 Red
96.78.15	MiG-21MF		Polish AF 7815 Red
96.79.01	MiG-21MF		Polish AF 7901 Red
96.79.02	MiG-21MF		Polish AF 7902 Red
96.79.03	MiG-21MF		Polish AF 7903 Red
96.79.04	MiG-21MF		Polish AF 7904 Red
96.79.05	MiG-21MF		Polish AF 7905 Red † 20-9-1977
96.79.06	MiG-21MF		Polish AF 7906 Red
96.79.07	MiG-21MF		Polish AF 7907 Red
96.79.08	MiG-21MF		Polish AF 7908 Red
96.79.09	MiG-21MF		Polish AF 7909 Red
96.79.10	MiG-21MF		Polish AF 7910 Red
96.79.11	MiG-21MF		Polish AF 7911 Red
96.79.12	MiG-21MF		Polish AF 7912 Red
96.79.13	MiG-21MF		Polish AF 7913 Red
96.79.14	MiG-21MF		Polish AF 7914 Red
96.79.15	MiG-21MF		Polish AF 7915 Red † 29-11-1983
96.80.01	MiG-21MF		Polish AF 8001 Red
96.80.02	MiG-21MF		Polish AF 8002 Red
96.80.03	MiG-21MF		Polish AF 8003 Red

96.80.04	MiG-21MF	Polish AF 8004 Red
96.80.05	MiG-21MF	Polish AF 8005 Red
96.80.06	MiG-21MF	Polish AF 8006 Red
96.80.07	MiG-21MF	Polish AF 8007 Red
96.80.08	MiG-21MF	Polish AF 8008 Red
96.80.09	MiG-21MF	Polish AF 8009 Red
96.80.10	MiG-21MF	Polish AF 8010 Red
96.80.11	MiG-21MF	Polish AF 8011 Red
96.80.12	MiG-21MF	Polish AF 8012 Red
96.80.13	MiG-21MF	Polish AF 8013 Red
96.80.14	MiG-21MF	Polish AF 8014 Red
96.80.15	MiG-21MF	Polish AF 8015 Red (1); see c/n 96008015
96.81.01	MiG-21MF	Polish AF 8101 Red
96.81.02	MiG-21MF, Lancer A*	Romanian AF 8102 Red, 8102 Black*
96.81.03	MiG-21MF, Lancer A*	Romanian AF 8103 Red, 8103 Black*
96.81.04	MiG-21MF, Lancer A*	Romanian AF 8104 Red, 8104 Black*
96.81.05	MiG-21MF, Lancer A*	Romanian AF 8105 Red, 8105 Black*
96.81.06	MiG-21MF	Romanian AF 8106 Red
96.81.07	MiG-21MF, Lancer A*	Romanian AF 8107 Red, 8107 Black*
96.81.08	MiG-21MF	Hungarian AF 8108 Red
96.81.09	MiG-21MF	Hungarian AF 8109 Red
96.81.10	MiG-21MF	Hungarian AF 8110 Red
96.81.11	MiG-21MF	Hungarian AF 8111 Red
96.81.12	MiG-21MF	Hungarian AF 8112 Red † 18-12-1975
96.81.13	MiG-21MF	Hungarian AF 8113 Red
96.81.14	MiG-21MF	Hungarian AF 8114 Red
96.81.15	MiG-21MF	Hungarian AF 8115 Red
96.82.01	MiG-21MF	Hungarian AF 8201 Red
96.82.02	MiG-21MF	Hungarian AF 8202 Red
96.82.03	MiG-21MF	Hungarian AF 8203 Red
96.82.04	MiG-21MF	Hungarian AF 8204 Red
96.86.06	MiG-21MF	East German AF 507 Red † 21-4-1988
96.86.08	MiG-21MF	East German AF 518 Red, Luftwaffe 23+20
96.86.09	MiG-21MF	East German AF 509 Red, Luftwaffe 23+14
96.86.10	MiG-21MF	East German AF 516 Red, Luftwaffe 23+19
96.86.11	MiG-21MF	East German AF 511 Red, Luftwaffe 23+16
96.86.12	MiG-21MF	East German AF 548 Red, Luftwaffe 23+22
96.86.13	MiG-21MF	East German AF 513 Red (EGAF '1513 Red'), Luftwaffe 23+17
96.86.14	MiG-21MF	East German AF 514 Red, Luftwaffe 23+18
96.86.15	MiG-21MF	East German AF 510 Red, Luftwaffe 23+15*
96.87.01	MiG-21MF	East German AF 512 Red † 25-6-1975
96.87.02	MiG-21MF	Polish AF 8702 Red
96.87.03	MiG-21MF	Polish AF 8703 Red
96.87.04	MiG-21MF	Polish AF 8704
96.87.05	MiG-21MF	Polish AF 8705
96.87.06	MiG-21MF	Polish AF 8706
96.87.07	MiG-21MF	Polish AF 8707
96.87.08	MiG-21MF	Somalia Aeronautical Corps 226
96.87.09	MiG-21MF	not known (Somalia Aeronautical Corps)
96.87.10	MiG-21MF	not known (Somalia Aeronautical Corps)
96.87.11	MiG-21MF	Somalia Aeronautical Corps 224
96.87.14	MiG-21MF	not known (Somalia Aeronautical Corps)
96.88.11	MiG-21MF	Somalia Aeronautical Corps 248
96.89.01	MiG-21MF	Somalia Aeronautical Corps 252
96.89.03	MiG-21MF	Somalia Aeronautical Corps 256
96.89.04	MiG-21MF	Somalia Aeronautical Corps 258
96.89.07	MiG-21MF	Polish AF 8907 Red
96.89.08	MiG-21MF	Polish AF 8908 Red † 14-11-1977
96.89.09	MiG-21MF	Polish AF 8909
96.89.10	MiG-21MF	Polish AF 8910
96.90.08	MiG-21MF	East German AF 529 Red † 5-9-1980
96.90.09	MiG-21MF	East German AF 535 Red (EGAF '1535 Red'), Luftwaffe 23+21
96.90.10	MiG-21MF	Polish AF 9010
96.90.11	MiG-21MF	Polish AF 9011 Red; 9011 White outline
96.90.12	MiG-21MF	Polish AF 9012 Red; 9012 White outline
96.90.13	MiG-21MF	Polish AF 9013 Red † 12-8-1975
96.90.14	MiG-21MF	Polish AF 9014
96.90.15	MiG-21MF	Polish AF 9015
96.91.01	MiG-21MF	Polish AF 9101
96.91.02	MiG-21MF	Polish AF 9102
96.91.03	MiG-21MF	Polish AF 9103
96.91.04	MiG-21MF	Polish AF 9104 Red † 31-12-1975
96.91.05	MiG-21MF	Polish AF 9105 Red
96.91.06	MiG-21MF	Polish AF 9106
96.91.07	MiG-21MF	Polish AF 9107 Red
96.91.08	MiG-21MF	Polish AF 9108
96.91.09	MiG-21MF	Polish AF 9109
96.91.10	MiG-21MF	Polish AF 9110
96.91.11	MiG-21MF	Polish AF 9111 Red; 9111 Grey
96.91.12	MiG-21MF	Polish AF 9112 Red
96.91.13	MiG-21MF	Polish AF 9113 Red
96.91.14	MiG-21MF	Polish AF 9114 Red
96.91.15	MiG-21MF	Polish AF 9115 Red
96.92.01	MiG-21MF	Polish AF 9201
96.92.02	MiG-21MF	Polish AF 9202
96.92.03	MiG-21MF	Polish AF 9203 Red † 6-3-1984
96.93.06	MiG-21MF	Hungarian AF 9306 Red
96.93.07	MiG-21MF	Hungarian AF 9307 Red
96.93.08	MiG-21MF	Hungarian AF 9308 Red
96.93.09	MiG-21MF	Hungarian AF 9309 Red
96.93.10	MiG-21MF	Hungarian AF 9310 Red
96.93.11	MiG-21MF	Hungarian AF 9311 Red
96.93.12	MiG-21MF	Hungarian AF 9312 Red
96.93.13	MiG-21MF	Hungarian AF 9313 Red † 18-1-1977
96.93.14	MiG-21MF	Hungarian AF 9314 Red † 5-6-1984
96.93.15	MiG-21MF	Hungarian AF 9315 Red
96.94.01	MiG-21MF	Bulgarian AF '51'
96.94.02	MiG-21MF	Bulgarian AF '52 White'
96.94.03	MiG-21MF, MiG-21MFR	Bulgarian AF '403'
96.94.04	MiG-21MF	30-6-74 Czechoslovak/Slovak AF '9404 Black'
96.94.05	MiG-21MF, MiG-21MFR	Bulgarian AF '55' † 16-7-1998
96.94.06	MiG-21MF	25-6-74 Czechoslovak/Slovak AF '9406 Black'
96.94.07	MiG-21MF, MiG-21MFR	Bulgarian AF '57'
96.94.08	MiG-21MF, MiG-21MFR	Bulgarian AF '58'
96.94.09	MiG-21MF	15-6-74 Czechoslovak/Czech AF 9409 Black
96.94.10	MiG-21MF	12-6-74 Czechoslovak/Czech AF 9410 Black
96.94.11	MiG-21MF	13-6-74 Czechoslovak/Czech AF 9411 Black
96.94.12	MiG-21MF	19-6-74 Czechoslovak/Czech AF 9412 Black
96.94.13	MiG-21MF	25-6-74 Czechoslovak/Czech AF 9413 Black
96.94.14	MiG-21MF	20-6-74 Czechoslovak/Czech AF 9414 Black
96.94.15	MiG-21MF	17-6-74 Czechoslovak/Czech AF 9415 Black
96.95.01	MiG-21MF	30-6-74 Czechoslovak/Slovak AF 9501 Black
96.95.02	MiG-21MF	30-6-74 Czechoslovak/Slovak AF 9502 Black
96.95.03	MiG-21MF	?-7/8-74? Czechoslovak/Czech AF 9503 Black
96.95.04	MiG-21MF, MiG-21MFR	Bulgarian AF '64'
96.95.05	MiG-21MF	Bulgarian AF '65' † 27-1-1984
96.95.06	MiG-21MF	Bulgarian AF '66' † 22-6-1985
96.95.07	MiG-21MF	Hungarian AF 9507 Red
96.95.08	MiG-21MF	Hungarian AF 9508 Red † 18-1-1977
96.95.09	MiG-21MF	Hungarian AF 9509 Red
96.95.10	MiG-21MF	Hungarian AF 9510 Red
96.95.11	MiG-21MF	Hungarian AF 9511 Red
96.95.12	MiG-21MF	Hungarian AF 9512 Red
96.95.13	MiG-21MF	Hungarian AF 9513 Red
96.95.14	MiG-21MF	Hungarian AF 9514 Red
96.95.15	MiG-21MF	Hungarian AF 9515 Red
96.96.01	MiG-21MF	Hungarian AF 9601 Red † 25-7-1985
96.96.02	MiG-21MF	Hungarian AF 9602 Red
96.96.03	MiG-21MF	Hungarian AF 9603 Red
96.96.04	MiG-21MF	Hungarian AF 9604 Red
96.96.05	MiG-21MF	Hungarian AF 9605 Red † 21-9-1991
96.96.06	MiG-21MF	Hungarian AF 9606 Red
96.96.07	MiG-21MF, Lancer A*	Romanian AF 9607 Red, 9607 Black*
96.96.08	MiG-21MF, Lancer A*	Romanian AF 9608 Red, 9608 Black*
96.96.09	MiG-21MF	Romanian AF 9609 Red
96.96.10	MiG-21MF, Lancer A*	Romanian AF 9610 Red, 9610 Black*

96.96.11		MiG-21MF, Lancer C*		Romanian AF 9611 Red, 9611 Black*
96.96.12		MiG-21MF, Lancer A*		Romanian AF 9612 Red, 9612 Black*
96.96.13		MiG-21MF, Lancer A*		Romanian AF 9613 Red, 9613 Black*
96.96.14		MiG-21MF		Romanian AF 9614 Red
96.96.15		MiG-21MF		Romanian AF 9615 Red
96.97.01		MiG-21MF, Lancer A*		Romanian AF 9701 Red, 9701 Black*
96.97.02		MiG-21MF, Lancer A*		Romanian AF 9702 Red, 9702 Black*
96.97.03		MiG-21MF, Lancer A*		Romanian AF 9703 Red, 9703 Black*
96.97.04		MiG-21MF		Romanian AF 9704 Red
96.97.05		MiG-21MF, Lancer A*		Romanian AF 9705 Red, 9705 Black*
96.97.06		MiG-21MF	?-8-74	Czechoslovak/Czech AF 9706 Black † 1-10-1991
96.97.07		MiG-21MF	28-8-74	Czechoslovak/Czech AF 9707 Black
96.97.08		MiG-21MF	26-8-74	Czechoslovak/Czech AF 9708 Black
96.97.09		MiG-21MF	26-8-74	Czechoslovak/Czech AF 9709 Black
96.97.10		MiG-21MF	31-8-74	Czechoslovak/Slovak AF 9710 Black
96.97.11		MiG-21MF	3-9-74	Czechoslovak/Czech AF 9711 Black
96.97.12		MiG-21MF	1-10-74	Czechoslovak/Slovak AF 9712 Black
96.97.13		MiG-21MF	26-8-74	Czechoslovak/Slovak AF 9713 Black
96.97.14		MiG-21MF	1-10-74	Czechoslovak/Czech AF 9714 Black
96.97.15		MiG-21MF	?-10-74	Czechoslovak AF 9715 Black † 3-3-1982
96.98.01		MiG-21MF	4-10-74	Czechoslovak/Czech AF 9801 Black
96.98.02		MiG-21MF	14-9-74	Czechoslovak/Czech AF 9802 Black † 23-1-1997
96.98.03		MiG-21MF	?-10-74	Czechoslovak AF 9803 Black † 4-5-1988
96.98.04		MiG-21MF	20-9-74	Czechoslovak/Czech AF 9804 Black
99.98.05		MiG-21MF	22-9-74	Czechoslovak/Czech AF 9805 Black
96.98.06		MiG-21MF, Lancer A*		Romanian AF 9806 Red, 9806 Black*
96.98.07		MiG-21MF		Romanian AF 9807 Red, 9807 Black
96.98.08		MiG-21MF, Lancer A*		Romanian AF 9808 Red, 9808 Black*
96.98.09		MiG-21MF, Lancer A*		Romanian AF 9809 Red, 9809 Black*
96.98.10		MiG-21MF, Lancer A*		Romanian AF 9810 Red, 9810 Black*
96.98.11		MiG-21MF, Lancer A*		Romanian AF 9811 Red, 9811 Black* † 26-3-2002
96.98.12		MiG-21MF	9-1974	Czechoslovak AF 9812 Black † 19-12-1985
96.98.13		MiG-21MF	20-9-74	Czechoslovak/Slovak AF 9813 Black
96.98.14		MiG-21MF	13-10-74	Czechoslovak/Slovak AF 9814 Black
96.98.15		MiG-21MF	8-10-74	Czechoslovak/Slovak AF 9815 Black
96.99.01		MiG-21MF	?-10/12-74	Czechoslovak AF 9901 Black † 21-4-1981
96.99.02		MiG-21MF	12-74?	Czechoslovak AF 9902 Black † 4-5-1988
960.01.001	0101?	MiG-21MF		East German AF 766 Red † 21-4-1988
960.01.012	0102?	MiG-21MF		East German AF 767 Red, Luftwaffe 23+41
960.01.039	01...?	MiG-21MF		East German AF 772 Red, Luftwaffe 23+42
960.01.085	?	MiG-21MF		East German AF 765 Red, East German AF 773 Red † 29-3-1976
960.01.091	?	MiG-21MF		East German AF 774 Red, Luftwaffe 23+43
960.02.003	?	MiG-21MF		East German AF 775 Red, Luftwaffe 23+44
960.02.009	?	MiG-21MF		East German AF 776 Red (EGAF '1776 Red'), Luftwaffe 23+45
960.02.022	?	MiG-21MF		East German AF 777 Red † 19-9-1980
960.02.037	?	MiG-21MF		East German AF 781 Red, Luftwaffe 23+47
960.02.045	?	MiG-21MF		East German AF 779 Red, Luftwaffe 23+46
960.02.112	?	MiG-21MF		East German AF 782 Red, Luftwaffe 23+48, 'Luftwaffe 22+28'
960.02.170	?	MiG-21MF		East German AF 784 Red, Luftwaffe 23+49, 'EGAF 784 Red'
960.02.205	?	MiG-21MF, MiG-21MFN	24-6-75	Czechoslovak/Czech AF 2205 Black
960.02.410	?	MiG-21MF	24-6-75	Czechoslovak/Czech AF 2410 Black
960.02.500	?	MiG-21MF, MiG-21MFN	25-6-75	Czechoslovak/Czech AF 2500 Black, Czech AF 2500 Grey
960.03.008	?	MiG-21MF, MiG-21MFN	25-6-75	Czechoslovak/Czech AF 3008 Black † 10-10-2000
960.04.003	?	MiG-21MF, MiG-21MFN	29-7-75	Czechoslovak/Czech AF 4003 Black
960.04.008	?	MiG-21MF	28-7-75	Czechoslovak/Czech AF 4008 Black
960.04.017	?	MiG-21MF, MiG-21MFN	29-8-75	Czechoslovak/Czech AF 4017 Black
960.04.038	?	MiG-21MF	1-8-75	Czechoslovak/Czech AF 4038 Black
960.04.101	?	MiG-21MF	1-8-75	Czechoslovak/Czech AF 4101 Black
960.04.127	?	MiG-21MF, MiG-21MFN	1-8-75	Czechoslovak/Czech AF 4127 Black
960.04.175	?	MiG-21MF, MiG-21MFN	29-8-75	Czechoslovak/Czech AF 4175 Black
960.04.307	?	MiG-21MF	29-8-75	Czechoslovak AF 4307 Black No. 2, Czechoslovak/Czech AF 9307 Black, N9307
960.04.405	?	MiG-21MF, MiG-21MFN	1-8-75	Czechoslovak/Czech AF 4405 Black, Czech AF 4405 Grey
960.04.421	?	MiG-21MF	1-8-75	Czechoslovak/Czech AF 4421 Black
960.05.494	?	MiG-21MF	1-8-75	Czechoslovak AF 5494 Black † 22-7-1980
960.05.508	?	MiG-21MF	1-8-75	Czechoslovak/Czech AF 5508 Black, Mali AF TZ-???
960.05.512	?	MiG-21MF	1-8-75	Czechoslovak/Czech AF 5512 Black, Mali AF TZ-???
960.05.581	?	MiG-21MF, MiG-21MFN	1-8-75	Czechoslovak/Czech AF 5581 Black
960.05.603	?	MiG-21MF, MiG-21MFN	1-9-75	Czechoslovak/Czech AF 5603 Black, Czech AF 5603 Grey
960.05.612	?	MiG-21MF	31-8-75	Czechoslovak/Czech AF 5612 Black
960.05.705	0417?	MiG-21MF, Lancer A*		Romanian AF 5705 Red, 5705 Black*
960.05.724	0418	MiG-21MF, Lancer C*		Romanian AF 5724 Red, 5724 Black*
960.05.788	0419	MiG-21MF, Lancer C*		Romanian AF 5788 Red, 5788 Black*
960.05.801	0420	MiG-21MF, Lancer C*		Romanian AF 5801 Red, 5801 Black*
960.05.819	0421?	MiG-21MF, Lancer C*		Romanian AF 5819 Red, 5819 Black* † 26-8-2004
960.05.834	0422?	MiG-21MF, Lancer C*		Romanian AF 5834 Red, 5834 Black*
960.05.902	0423?	MiG-21MF, MiG-21-2000*		Romanian AF 5902 Red, 5902 Black*
960.05.917	0424?	MiG-21MF, Lancer C*		Romanian AF 5917 Red, 5917 Black*
960.06.010	0425?	MiG-21MF, Lancer C*		Romanian AF 6010 Red, 6010 Black*
960.06.025	0501?	MiG-21MF, Lancer C*		Romanian AF 6025 Red, 6025 Black* † 25-9-2003
960.06.040	0502?	MiG-21MF		Romanian AF 6040 Red, 6040 Black
960.06.105	0503?	MiG-21MF, Lancer C*		Romanian AF 6105 Red, 6105 Black*
960.06.196	0504?	MiG-21MF, Lancer C*		Romanian AF 6196 Red, 6196 Black*
960.06.203	0505?	MiG-21MF, Lancer C*		Romanian AF 6203 Red, 6203 Black*
960.06.207	0506?	MiG-21MF, Lancer C*		Romanian AF 6207 Red, 6207 Black*
960.06.305	0507	MiG-21MF, Lancer C*		Romanian AF 6305 Red, 6305 Black*
960.06.413	0510?	MiG-21MF, Lancer C*		Romanian AF 6413 Red, 6413 Black* † 8-3-2005
960.06.421	0511?	MiG-21MF, Lancer A*		Romanian AF 6421 Red, 6421 Black*
960.06.487	0512?	MiG-21MF, Lancer C*		Romanian AF 6487 Red, 6487 Black*
960.06.499	0513?	MiG-21MF, Lancer C*		Romanian AF 6499 Red, 6499 Black*
960.06.503	0514?	MiG-21MF, Lancer A*		Romanian AF 6503 Red, 6503 Black*
960.06.518	0515	MiG-21MF, Lancer C*		Romanian AF 6518 Red, 6518 Black*
960.06.581	0516	MiG-21MF, Lancer A*		Romanian AF 6581 Red, 6581 Black*
960.06.607	0517	MiG-21MF, Lancer C*		Romanian AF 6607 Red, 6607 Black*
960.06.693	0518	MiG-21MF, Lancer A*		Romanian AF 6693 Red, 6693 Black*
960.06.700	0519	MiG-21MF, Lancer C*		Romanian AF 6700 Red, 6700 Black* † 26-8-2004
960.06.707	0520	MiG-21MF, Lancer C*		Romanian AF 6707 Red, 6707 Black*
960.06.721	0521	MiG-21MF, Lancer C*		Romanian AF 6721 Red, 6721 Black* † 27-11-2006
960.06.801	0522	MiG-21MF, Lancer A*		Romanian AF 6801 Red, 6801 Black*
960.06.807	0523	MiG-21MF, Lancer C*		Romanian AF 6807 Red, 6807 Black*
960.06.824	0524?	MiG-21MF, Lancer C*		Romanian AF 6824 Red, 6824 Black*
960.06.840	0525?	MiG-21MF, Lancer C*		Romanian AF 6840 Red, 6840 Black*
960.07.011	0601?	MiG-21MF, Lancer A*		Romanian AF 7011 Red, 7011 Black*
960.07.017	0602?	MiG-21MF, Lancer C*		Romanian AF 7017 Red, 7017 Black* † 13-7-2001
960.07.021	0603?	MiG-21MF		Bulgarian AF '021'
960.07.029	0604?	MiG-21MF		Bulgarian AF '029'
960.07.033	0605?	MiG-21MF		Bulgarian AF '033'
960.07.047	0606?	MiG-21MF, MiG-21MFR		Bulgarian AF '047'
960.07.111	0607	MiG-21MF		Bulgarian AF '111'
960.07.133	?	MiG-21MF		Bulgarian AF '133'
960.07.151	?	MiG-21MF		Bulgarian AF '151'
960.07.177	?	MiG-21MF		Bulgarian AF '177'
960.07.213	?	MiG-21MF		Bulgarian AF '213'
960.07.247	?	MiG-21MF		Bulgarian AF '247' † 22-10-84
960.07.301	?	MiG-21MF		Bulgarian AF '301'
960.07.399	?	MiG-21MF		Polish AF 7399 Red
960.07.405	?	MiG-21MF		Polish AF 7405 Red † 1-3-1991
960.07.436	?	MiG-21MF		Polish AF 7436 Red
960.07.489	?	MiG-21MF		Polish AF 7489 Red
960.07.502	?	MiG-21MF		Polish AF 7502 Red
960.07.555	?	MiG-21MF		Polish AF 7555 Red
960.07.600	?	MiG-21MF		Polish AF 7600 Red
960.07.656	?	MiG-21MF		Polish AF 7656 Red
960.07.675	?	MiG-21MF		Polish AF 7675 Red
960.07.715	?	MiG-21MF		Polish AF 7715 Red
960.07.760	?	MiG-21MF		Polish AF 7760 Red
960.07.788	?	MiG-21MF		Polish AF 7788 Red
960.08.015	?	MiG-21MF		Polish AF 8015 Red No. 2; see c/n 968015

960.08.022	?	MiG-21MF		Polish AF 8022 Red
960.08.039	?	MiG-21MF		Polish AF 8039 Red
960.08.055	?	MiG-21MF		Polish AF 8055 Red
960.08.099	?	MiG-21MF		Polish AF 8099 Red
960.08.113	?	MiG-21MF		Polish AF 8113 Red
960.08.122	?	MiG-21MF		Polish AF 8122 Red
960.08.189	?	MiG-21MF		Polish AF 8189 Red
960.08.205	?	MiG-21MF	15-9-73	Czechoslovak/Slovak AF 8205 Black'
960.08.206	?	MiG-21MF	22-9-73	Czechoslovak/Czech AF 8206 Black'
960.08.207	?	MiG-21MF	17-9-73	Czechoslovak/Slovak AF 8207 Black
960.08.208	?	MiG-21MF	29-9-73	Czechoslovak/Slovak AF 8208 Black'
960.08.209	?	MiG-21MF	20-9-73	Czechoslovak/Slovak AF 8209 Black'
960.10.112	?	MiG-21MF		Vietnamese People's AF '5121 Red'
960.11.507	?	MiG-21MF		not known (Iraqi AF)
960.11.804	?	MiG-21MF		Soviet AF '71 Blue' (or MiG-21M c/n 961804?)
960.14.024?	?	MiG-21MF?		Laotian People's Liberation Army AF '14'
500AT01	1601	MiG-21SMT		Soviet AF '11 Yellow'
500AT15	1615	MiG-21SMT		no code (Soviet AF)
500ACh02	1702	MiG-21SMT		not known (Soviet AF), '17 Red'?
500.19.005?	?	MiG-21SMT		Soviet AF '11 Red' c/n also reported as 50014005
500.19.105	?	MiG-21SMT		Soviet AF '52 Yellow'
500.22.121	?	MiG-21SMT		Soviet AF '24 Red', '01 Red', '60 Red'
500.23.098	2119?	MiG-21SMT		Soviet AF '09 Yellow'
500.23.100	2120	MiG-21SMT		Soviet AF '10 Yellow'
500.27.021	2304	MiG-21SMT		not known (Soviet AF)
		MiG-21ST		Soviet AF '76 Yellow'
500.29.107	23...	MiG-21SMT		Soviet AF '42 Yellow
500.29.804	2317	MiG-21SMT		not known (Soviet AF) c/n also rep. as 50029084
		MiG-21ST		Soviet AF '40 Yellow'
750.01.012	0102	MiG-21*bis*, Lancer III *		not known; Romanian AF 165 Black*
750.01.041	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '80 White'
750.01.105	?	MiG-21*bis* (*izd.* 75B)		not known (Soviet AF)
		MiG-21-93		Russian AF '21-93 Blue'
750.02.198	?	MiG-21*bis*		Soviet AF '01 Red'
750.02.75...	?	MiG-21*bis* (*izd.* 75A), MiG-21*bis*D		not known, Croatian AF 115 Black
750.03.008	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '86 White'
750.03.013	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '513 White'
750.03.025	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '525 White'
750.03.061	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '561 White'
750.03.092	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '81'
750.03.117	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '82'
750.06.258	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '558'
750.07.003	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '503 White'
750.07.023	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '523 White'
750.07.030	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '530 White'
750.07.420	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '520 White'
750.08.059	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '559 White'
750.09.521	?	MiG-21*bis Fishbed-L*		Soviet AF (not known)
		MiG-21-93		Russian AF '351'
750.11.350	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '550 White'
750.11.394	?	MiG-21*bis*		Soviet AF '35 Blue'
750.12.409	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '509 White'
750.14.699		MiG-21*bis*		Soviet/Russian AF '45 Red'
750.14.898	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '87'
750.14.904	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '88 White'
750.14.947		MiG-21*bis*		Soviet/Russian AF '53 Red'
750.16.609	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '516 White'
750.17.009	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '517 White'
750.17.715	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '515'
750.17.895	?	MiG-21*bis* (*izd.* 75A), MiG-21*bis*D		not known, Croatian AF 110 Black
750.17.953	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '553 White'
750.19.901	1317	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '501 White
750.19.927	13...?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '83'
750.21.145	?	MiG-21*bis* (*izd.* 75A), MiG-21*bis*D		not known, Croatian AF 121 Black
750.21.148	?	MiG-21*bis Fishbed-N*		Soviet AF '48 Blue'
750.21.730	?	MiG-21*bis*		Soviet/Ukrainian AF '17 Red'
750.24.027	?	MiG-21*bis* (*izd.* 75B)		Bulgarian AF '027 White'
750.27.008		MiG-21*bis*		Soviet AF '07 '
750.27.102	?	MiG-21*bis* (*izd.* 75B)		Bulgarian AF '102 White'
750.28.727	?	MiG-21*bis* (*izd.* 75B)		Bulgarian AF '727'
750.28.850	?	MiG-21*bis* (*izd.* 75B)		Bulgarian AF '850 White'
750.28.903	?	MiG-21*bis* (*izd.* 75B)		Bulgarian AF '903 White'
750.28.947	?	MiG-21*bis* (*izd.* 75B)		Bulgarian AF '947'
750.28.947	?	MiG-21*bis* (*izd.* 75B)		Bulgarian AF '947'
750.29.617	?	MiG-21*bis Fishbed-N*		Soviet/Russian AF '61 White outline'
750.33.127	?	MiG-21*bis* (*izd.* 75B)		Bulgarian AF '84' No. 1, Bulgarian AF '502 White' No. 2
750.33.148	?	MiG-21*bis* (*izd.* 75A)		East German AF 871 Red, Luftwaffe 24+26
750.33.151	?	MiG-21*bis* (*izd.* 75A)		East German AF 872 Red, Luftwaffe 24+27
750.33.169	?	MiG-21*bis* (*izd.* 75A)		East German AF 873 Red, Luftwaffe 24+28*
750.33.205	?	MiG-21*bis* (*izd.* 75A)		East German AF 874 Red, Luftwaffe 24+29
750.33.211	?	MiG-21*bis* (*izd.* 75A)		East German AF 875 Red, Luftwaffe 24+30
750.33.213	?	MiG-21*bis* (*izd.* 75A)		East German AF 876 Red, Luftwaffe 24+31
750.33.219	?	MiG-21*bis* (*izd.* 75A)		East German AF 879 Red, Luftwaffe 24+32
750.33.305	?	MiG-21*bis* (*izd.* 75A)		East German AF 881 Red, Luftwaffe 24+33
750.33.397	?	MiG-21*bis* (*izd.* 75A)		East German AF 882 Red No. 2, Luftwaffe 24+34
750.33.419	?	MiG-21*bis* (*izd.* 75A)		East German AF 886 Red, Luftwaffe 24+35
750.33.445	?	MiG-21*bis* (*izd.* 75A)		East German AF 892 Red, Luftwaffe 24+37
750.33.507	?	MiG-21*bis* (*izd.* 75A)		East German AF 893 Red, Luftwaffe 24+38
750.33.515	?	MiG-21*bis* (*izd.* 75A)		East German AF 895 Red, Luftwaffe 24+39
750.33.522	?	MiG-21*bis* (*izd.* 75A)		East German AF 899 Red, Luftwaffe 24+40
750.33.537	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 3537 Red
750.33.547	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 3547 Red † 14-3-1989
750.33.732	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 3732 Red
750.33.745	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 3745 Red
750.33.931	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 3931 Red † 14-3-1989
750.33.945	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 3945 Red
750.33.955	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 3955 Red
750.33.964	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 3964 Red
750.33.987	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 3987 Red † 9-6-1981
750.34.009	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 4009 Red
750.34.025	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 4025 Red
750.34.029	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 4029 Red † 27-8-1981
750.34.058	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 4058 Red
750.34.097	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 4097 Red † 7-7-1983?
750.34.112	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 4112 Red
750.34.133	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 4133 Red † 3-8-1976
750.34.645	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '545'
750.34.681	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '95'
750.34.730	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '89'
750.34.745	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '96 White'
750.35.190	?	MiG-21*bis* (*izd.* 75B)		East German AF 887 Red, Luftwaffe 24+36
750.35.201	?	MiG-21*bis* (*izd.* 75B)		East German AF 900 Red, Luftwaffe 24+41
750.35.213	?	MiG-21*bis* (*izd.* 75B)		East German AF 904 Red, Luftwaffe 24+42
750.35.284	?	MiG-21*bis* (*izd.* 75B)		East German AF 916 Red, Luftwaffe 24+43
750.35.289	?	MiG-21*bis* (*izd.* 75B)		East German AF 917 Red, Luftwaffe 24+44
750.35.291	?	MiG-21*bis* (*izd.* 75B)		East German AF 920 Red, Luftwaffe 24+45
750.35.304	?	MiG-21*bis* (*izd.* 75B)		East German AF 933 Red, Luftwaffe 24+46
750.35.321	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 5321 Red † 1-3-1984
750.35.374	?	MiG-21*bis* (*izd.* 75B)		East German AF 936 Red No. 2, Luftwaffe 24+47
750.35.385	?	MiG-21*bis* (*izd.* 75B)		East German AF 941 Red † 3-8-1979
750.35.399	?	MiG-21*bis* (*izd.* 75B)		East German AF 946 Red, Luftwaffe 24+48
750.35.400	?	MiG-21*bis* (*izd.* 75B)		East German AF 950 Red † 9-3-1983
750.35.407	?	MiG-21*bis* (*izd.* 75B)		East German AF 951 Red, Luftwaffe 24+49
750.35.422	?	MiG-21*bis* (*izd.* 75B)		East German AF 954 Red, Luftwaffe 24+50
750.35.445	?	MiG-21*bis* (*izd.* 75B)		East German AF 956 Red, Luftwaffe 24+51
750.35.501	?	MiG-21*bis* (*izd.* 75B)		East German AF 957 Red † 20-2-1987
750.35.502	?	MiG-21*bis* (*izd.* 75B)		East German AF 978 Red, Luftwaffe 24+52
750.35.531	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 5531 Red
750.35.540	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 5540 Red
750.35.705	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 5705 Red † 13-12-1977
750.35.721	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 5721 Red
750.35.809	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 5809 Red
750.35.822	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 5822 Red
750.35.841	?	MiG-21*bis* (*izd.* 75B)		East German AF 990 Red, Luftwaffe 24+53
750.36.007	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 6007 Red

750.36.009	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 6009 Red
750.36.021	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 6021 Red
750.36.115	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 6115 Red
750.36.316	?	MiG-21*bis* (*izd.* 75A)		Algerian AF FA-62
750.36.401	?	MiG-21*bis* (*izd.* 75A)		Algerian AF FA-52
750.37.821	?	MiG-21*bis* (*izd.* 75A)		Algerian AF 132
750.37.857?	?	MiG-21*bis* (*izd.* 75A)		not known (Algerian AF)
750.38.399	?	MiG-21*bis* (*izd.* 75A)		Algerian AF FA-92
750.38.210	?	MiG-21*bis* (*izd.* 75A)		Algerian AF FA-94
750.41.927?	?	MiG-21*bis Fishbed-N*		Ukrainian AF '01 Blue'
750.44.702	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '502 White' No. 1, Bulgarian AF '84 White' No. 2
750.46.145	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 6145 Red
750.46.207	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 6207 Red † 7-7-1983
750.46.224	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 6224 Red † 11-11-1980
750.46.253	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 6253 Red
750.46.305	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 6305 Red
750.46.327	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 6327 Red
750.46.384	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 6384 Red
750.47.504	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 6264 Red
750.49.099	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 9099 Red
750.49.125	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 9125 Red
750.49.178	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 9178 Red
750.49.207	?	MiG-21*bis* (*izd.* 75A)		Hungarian AF 9207 Red † 17-10-1981
750.49.666	3122	MiG-21*bis* (*izd.* 75B)		Yugoslav/Serbian AF 17126
750.51.035	?	MiG-21*bis* (*izd.* 75B)		East German AF 792 Red, Luftwaffe 24+13
750.51.108	?	MiG-21*bis* (*izd.* 75B)		East German AF 794 Red, Luftwaffe 24+14
750.51.121	?	MiG-21*bis* (*izd.* 75B)		East German AF 797 Red, Luftwaffe 24+15
750.51.345	?	MiG-21*bis* (*izd.* 75B)		East German AF 835 Red, Luftwaffe 24+16
750.51.347	?	MiG-21*bis* (*izd.* 75B)		East German AF 837 Red, Luftwaffe 24+17
750.51.378	?	MiG-21*bis* (*izd.* 75B)		East German AF 838 Red, Luftwaffe 24+18
750.51.384	?	MiG-21*bis* (*izd.* 75B)		East German AF 840 Red, Luftwaffe 24+19
750.51.400	?	MiG-21*bis* (*izd.* 75B)		East German AF 844 Red † 21-2-1990
750.51.402	?	MiG-21*bis* (*izd.* 75B)		East German AF 846 Red, Luftwaffe 24+20
750.51.405	?	MiG-21*bis* (*izd.* 75B)		East German AF 848 Red No. 2, Luftwaffe 24+21
750.51.426	?	MiG-21*bis* (*izd.* 75B)		East German AF 849 Red, Luftwaffe 24+22*
750.53.407	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '92'
750.53.569	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '93'
750.53.824	?	MiG-21*bis*		Soviet/Russian AF '08 Red'
750.54.147	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '85'
750.58.003	?	MiG-21*bis* (*izd.* 75B)		East German AF 850 Red, Luftwaffe 24+23
750.58.015	?	MiG-21*bis* (*izd.* 75B)		East German AF 853 Red, Luftwaffe 24+24
750.58.087	?	MiG-21*bis* (*izd.* 75B)		East German AF 856 Red, Luftwaffe 24+25
750.58.099	?	MiG-21*bis* (*izd.* 75B)		East German AF 859 Red
750.61.844	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 1844 Red
750.61.867	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 1867 Red
750.61.874	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 1874 Red
750.61.889	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 1889 Red
750.61.900	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 1900 Red
750.61.904	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 1904 Red
750.61.953	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 1953 Red
750.61.968	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 1968 Red
750.62.001	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 2001 Red † 10-6-1988
750.62.021	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 2021 Red
750.62.098	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 2098 Red
750.62.105	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 2105 Red
750.64.540	?	MiG-21*bis* (*izd.* 75A)	1978	Finnish AF MB-111, MG-111
750.64.587	?	MiG-21*bis*/T	1978	Finnish AF MB-114, MG-114
750.70.101	?	MiG-21*bis* (*izd.* 75A)		Iraqi AF 21xxx
750.76.118	?	MiG-21*bis* (*izd.* 75B?)		Vietnamese People's AF '5236 Red'
750.77.711	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 41 Red
750.77.729	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 42 Red
750.77.754	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 43 Red
750.77.798	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 44 Red † 12-4-1984
750.77.800	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 45 Red † 19-8-1988
750.77.805	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 46 Red
750.77.813	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 47 Red
750.78.604	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8604 Red, Polish Navy 8604 Red
750.78.645	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8645 Red, Polish Navy 8645 Red † 5-8-1992
750.78.649	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8649 Red, Polish Navy 8649 Red
750.78.705	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8705 Red, Polish Navy 8705 Red
750.78.745	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8745 Red, Polish Navy 8745 Red
750.78.801	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8801 Red, Polish Navy 8801 Red
750.78.819	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8819 Red, Polish Navy 8819 Red
750.78.822	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8822 Red, Polish Navy 8822 Red
750.78.855	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8855 Red, Polish Navy 8855 Red
750.78.859	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8859 Red, Polish Navy 8859 Red
750.78.861	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8861 Red, Polish Navy 8861 Red
750.78.865	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8865 Red, Polish Navy 8865 Red
750.78.870	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8870 Red, Polish Navy 8870 Red
750.78.880	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8880 Red, Polish Navy 8880 Red
750.78.890	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8890 Red, Polish Navy 8890 Red
750.78.905	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8905 Red, Polish Navy 8905 Red
750.78.910	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8910 Red, Polish Navy 8910 Red
750.78.918	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8918 Red, Polish Navy 8918 Red † 25-2-1994
750.79.157	?	MiG-21*bis* (*izd.* 75A)		not known, Croatian AF 120 Black
750.80.601	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '94'
750.80.614	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '90 White'
750.80.645	?	MiG-21*bis* (*izd.* 75A)		Soviet AF (not known), Bulgarian AF '91'
750.80.701	?	MiG-21*bis* (*izd.* 75A)		Polish AF 0701 Red † 13-4-1989
750.80.774	?	MiG-21*bis* (*izd.* 75A)		Polish AF 0774 Red, Polish Navy 0774 Red
750.80.786	?	MiG-21*bis* (*izd.* 75A)		Polish AF 0786 Red † 26-1-1981
750.80.798	?	MiG-21*bis* (*izd.* 75A)		Polish AF 0798 Red, Polish Navy 0798 Red
750.80.800	?	MiG-21*bis* (*izd.* 75A)		Polish AF 0800 Red, Polish Navy 0800 Red
750.80.804	?	MiG-21*bis* (*izd.* 75A)		Polish AF 0804 Red, Polish Navy 0804 Red
750.80.809	?	MiG-21*bis* (*izd.* 75A)		Polish AF 0809 Red, Polish Navy 0809 Red
750.80.845	?	MiG-21*bis* (*izd.* 75A)		Polish AF 0845 Red
750.80.876	?	MiG-21*bis* (*izd.* 75A)		Polish AF 0876 Red, Polish Navy 0876 Red
750.80.880	?	MiG-21*bis* (*izd.* 75A)		Polish AF 0880 Red, Polish Navy 0880 Red
750.80.887	?	MiG-21*bis* (*izd.* 75A)		Polish AF 0887 Red, Polish Navy 0887 Red † 29-10-1999
750.81.007	?	MiG-21*bis* (*izd.* 75A)		Polish AF 1007 Red, Polish Navy 1007 Red
750.81.029	?	MiG-21*bis* (*izd.* 75A)		Polish AF 1029 Red, Polish Navy 1029 Red
750.81.501	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 48 Red
750.81.510	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 49 Red
750.81.614	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 50 Red
750.81.637	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 51 Red
750.81.645	?	MiG-21*bis* (*izd.* 75B)		Hungarian AF 52 Red † 7-7-1981
750.83.858	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-115 † 24-8-1984
750.83.895	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-116
750.83.914	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-117 † 5-11-1991
750.83.945	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-118
750.83.978	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-120 † 30-9-1986
750.84.145	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-122 † 22-3-1995
750.84.151	?	MiG-21*bis*/T	1980	Finnish AF MG-124
750.84.204	?	MiG-21*bis*/T	1980	Finnish AF MG-125
750.84.215	?	MiG-21*bis*/T	1980	Finnish AF MG-127
750.84.300	?	MiG-21*bis*/T	1980	Finnish AF MG-129
750.84.403	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-130
750.84.511	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-131
750.84.542	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-132
750.84.545	?	MiG-21*bis*/T	1980	Finnish AF MG-133
750.84.554	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-135
750.84.608	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-138
750.84.622	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-139 † 11-6-1982
750.84.645	?	MiG-21*bis* (*izd.* 75A)	1980	Finnish AF MG-140
750.85.304	?	MiG-21*bis*		not known, Namibian AF (not known)
750.87.309	?	MiG-21*bis* (*izd.* 75B)		Congolese AF 509
750.87.406	?	MiG-21*bis* (*izd.* 75B)		Congolese AF 511
750.87.444	?	MiG-21*bis* (*izd.* 75B)		Congolese AF 513
750.87.458	?	MiG-21*bis* (*izd.* 75B)		Congolese AF 515
750.88.945	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8945 Red, Polish Navy 8945 Red
750.88.971	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8971 Red, Polish Navy 8971 Red
750.88.980	?	MiG-21*bis* (*izd.* 75A)		Polish AF 8980 Red, Polish Navy 8980 Red
750.89.027	?	MiG-21*bis* (*izd.* 75A)		Polish AF 9027 Red † 17-6-1982
750.89.095	?	MiG-21*bis* (*izd.* 75A)		Polish AF 9095 Red † 16-6-1988

750.89.145	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9145 Red
750.89.204	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9204 Red
750.89.211	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9211 Red, Uganda Army AF 9211 Red
750.89.307	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9307 Red, Uganda Army AF 9307 Red
750.89.314	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9314 Red
750.89.320	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9320 Red
750.89.334	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9334 Red
750.89.345	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9345 Red
750.89.381	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9381 Red
750.89.407	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9407 Red
750.89.424	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9424 Red
750.89.444	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9444 Red
750.89.483	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9483 Red
750.89.494	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9494 Red
750.89.501	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9501 Red
750.89.507	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9507 Red
750.89.524	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9524 Red
750.89.545	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9545 Red
750.89.564	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9564 Red
750.89.700	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9700 Red
750.89.703	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9703 Red
750.89.708	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9708 Red
750.89.735	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9735 Red
750.89.745	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9745 Red
750.89.749	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9749 Red † 29-9-2001
750.89.763	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9763 Red
750.89.784	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9784 Red
750.89.799	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9799 Red, Uganda Army AF 9799 Red
750.89.801	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9801 Red, Polish AF '07 Red', Uganda Army AF 9801 Red
750.89.805	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9805 Red
750.89.809	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9809 Red
750.89.811	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9811 Red, Uganda Army AF 9811 Red
750.89.818	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9818 Red, Uganda Army AF 9818 Red
750.89.843	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9843 Red
750.89.854	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9854 Red
750.89.975	?	MiG-21*bis* (*izd.* 75A)	Polish AF 9975 Red
750.91.174	?	MiG-21*bis Fishbed-L*	not known (Soviet AF), '08 Blue' (NAZ Sokol)
750.91.800	?	MiG-21*bis* (*izd.* 75B)	Angolan AF C340??? see c/n 75096900!
750.92.119	?	MiG-21*bis* (*izd.* 75B)	Yugoslav AF 17133, Croatian AF 101 † 24-6-1992
750.92.741	?	MiG-21*bis* (*izd.* 75A)	Yugoslav AF 17235, Croatian AF 102 White *Osvetnik Dubrovnika*, 102 Black
750.92.823	?	MiG-21*bis*	not known (Soviet AF)
750.92.905	?	MiG-21*bis* (*izd.* 75A)	Yugoslav AF 17xxx, Croatian AF '118'
750.92.923	?	MiG-21*bis* (*izd.* 75A), MiG-21*bisD*	not known, Croatian AF 117 Black
750.93.067	?	MiG-21*bis* (*izd.* 75A)	Iraqi AF 21xxx
750.93.463	?	MiG-21*bis* (*izd.* 75A)	Iraqi AF 21xxx
750.94.013	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '013 White'
750.94.025	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '025 White'
750.94.045	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '045 White'
750.94.051	?	MiG-21*bis* (*izd.* 75B)	Yugoslav AF 17167, Croatian AF '103' *Osvetnik Vukovara* † 14-9-1993
750.94.088	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '088'
750.94.101	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '101'
750.94.114	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '114 White'
750.94.119	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '119 White'
750.94.127	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '127'
750.94.240	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '240'
750.94.243	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '243 White'
750.94.249	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '249'
750.94.254	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '254 White'
750.94.261	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '261 White'
750.94.277	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '277'
750.94.294	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '294 White'
750.94.302	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '302 White'
750.94.317	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '317'
750.94.324	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '324 White'
750.94.240	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '340 White'
750.94.345	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '345 White'
750.94.358	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '358 White'
750.94.362	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '362 White'
750.94.365	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '365 White'
750.94.370	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '370 White'
750.94.383	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '383 White'
750.94.388	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '388 White'
750.94.392	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '392 White'
750.94.399	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '399 White'
750.94.401	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '401'
750.94.407	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '407 White'
750.94.413	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '413 White'
750.94.407	?	MiG-21*bis* (*izd.* 75B)	Bulgarian AF '427 White'
750.95.084	?	MiG-21*bis*	Mozambique AF '202 Blue'
750.95.095	?	MiG-21*bis*	Mozambique AF '203'
750.95.103	?	MiG-21*bis*	Mozambique AF '204'
750.95.145	?	MiG-21*bis*	Mozambique AF '207'
750.95.222	?	MiG-21*bis* (*izd.* 75B)	Yugoslav AF 17402
750.95.251	?	MiG-21*bis* (*izd.* 75B)	Yugoslav AF 17405
750.95.293	?	MiG-21*bis* (*izd.* 75B)	Yugoslav AF 17409
750.96.037	?	MiG-21*bis*	Mozambique AF '221'
750.96.055	?	MiG-21*bis*	Mozambique AF '222'
750.96.105	?	MiG-21*bis*	Mozambique AF '226'
750.96.124	?	MiG-21*bis*	Mozambique AF '227'
750.96.176	?	MiG-21*bis*	Mozambique AF '228'
750.96.182	?	MiG-21*bis*	Mozambique AF '229'
750.96.189	?	MiG-21*bis*	Mozambique AF '231 Blue'
750.96.238	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7105
750.96.246	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7104
750.96.253	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7107
750.96.261	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7109
750.96.284	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7101
750.96.289	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7102
750.96.320	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7112
750.96.328	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7111
750.96.409	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7106
750.96.424	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7110
750.96.435	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7103
750.96.461	?	MiG-21*bis* (*izd.* 75B)	Congolese AF 525
750.96.524	?	MiG-21*bis*	Mozambique AF '241 Red'
750.96.601	?	MiG-21*bis*	Mozambique AF '242'
750.96.608	?	MiG-21*bis*	Mozambique AF '244'
750.96.624	?	MiG-21*bis*	Mozambique AF '245'
750.96.782	?	MiG-21*bis*	Mozambique AF '149'
750.96.900	?	MiG-21*bis* (*izd.* 75B)	Angolan AF C340
750.97.417	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7116
750.97.442	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7117
750.97.455	?	MiG-21*bis*	?, Namibian AF (not known)
750.97.461	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7119
750.97.468	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7120
750.97.504	?	MiG-21*bis* (*izd.* 75B)	Royal Cambodian AF 7121
750.98.121	?	MiG-21*bis* (*izd.* 75A)	1985 Finnish AF 'MG-118', MG-119
750.98.124	?	MiG-21*bis* (*izd.* 75A)	1985 Finnish AF 'MG-127', MG-128 † 11-11-1992
750.98.129	?	MiG-21*bis* (*izd.* 75A)	1985 Finnish AF 'MG-135', MG-136
750.98.132	?	MiG-21*bis* (*izd.* 75A)	1986 Finnish AF 'MG-124', MG-121
750.98.140	?	MiG-21*bis* (*izd.* 75A)	1986 Finnish AF 'MG-126', MG-123
750.98.143	?	MiG-21*bis* (*izd.* 75A)	1986 Finnish AF 'MG-132', MG-134

MiG-21U – a) Tbilisi production (plant No. 31)

07.66.51.06	MiG-21U (*izd.* 66-400)	not known (Soviet AF)
08.66.51.06	MiG-21U (*izd.* 66-600)	not known (Soviet AF)
07.66.51.09	MiG-21U (*izd.* 66-600)	not known (Soviet AF)
51.66.07.03?	MiG-21U (*izd.* 66-400)	Indonesian AF T2171
51.66.07.04?	MiG-21U (*izd.* 66-400)	Indonesian AF T2172

b) Moscow production

66.08.16	MiG-21U (*izd.* 66-400)	Czechoslovak AF 0816 Black, OK-016, Czech AF 0816 Black
66.08.17	MiG-21U (*izd.* 66-400)	Czechoslovak/Czech AF 0817 Black

66.08.18	MiG-21U (*izd.* 66-400)	East German AF 235 Black
66.08.19	MiG-21U (*izd.* 66-400)	East German AF 260 Black
66.08.20	MiG-21U (*izd.* 66-400)	Hungarian AF 0820 Red, Indian AF U670
66.09.16	MiG-21U (*izd.* 66-400)	East German AF 245 Black † 9-8-1976
66.09.17	MiG-21U (*izd.* 66-400)	East German AF 239 Black
66.09.18	MiG-21U (*izd.* 66-400)	East German AF 241 Black † 12-7-1980
66.09.19	MiG-21U (*izd.* 66-400)	Hungarian AF 919 Red, Indian AF U3001
66.09.20	MiG-21U (*izd.* 66-400)	East German AF 243 Black † 13-5-1967
66.10.16	MiG-21U (*izd.* 66-400)	East German AF 251 Black, Luftwaffe 23+88
66.10.17	MiG-21U (*izd.* 66-400)	East German AF 244 Black, Luftwaffe 23+87
66.10.18	MiG-21U (*izd.* 66-400)	East German AF 255 Black † 9-7-1973
66.10.19	MiG-21U (*izd.* 66-400)	East German AF 253 Black † 10-5-1969
66.10.20	MiG-21U (*izd.* 66-400)	East German AF 247 Black
66.11.16	MiG-21U (*izd.* 66-400)	East German AF 249 Black † 25-8-1971
66.11.17	MiG-21U (*izd.* 66-400)	Czechoslovak/Czech AF 1117 Black
66.11.18	MiG-21U (*izd.* 66-400)	East German AF 258 Black, Luftwaffe 23+89, 'Luftwaffe 23 19'
66.11.19	MiG-21U (*izd.* 66-400)	East German AF 237 Black, Luftwaffe 23+86
66.11.20	MiG-21U (*izd.* 66-400)	Romanian AF 1120 Red
66.12.16	MiG-21U (*izd.* 66-400)	Romanian AF 1216 Red, 1216 Black
66.12.17	MiG-21U (*izd.* 66-400)	Polish AF 1217 Red
66.12.18	MiG-21U (*izd.* 66-400)	Polish AF 1218 Red
66.12.19	MiG-21U (*izd.* 66-400)	Polish AF 1219 Red † 11-5-1971
66.12.20	MiG-21U (*izd.* 66-400)	Polish AF 1220 Red † 14-6-1978
66.13.17	MiG-21U (*izd.* 66-400)	Polish AF 1317 Red † 16-1-1978
66.13.18	MiG-21U (*izd.* 66-400)	Polish AF 1318 Red
66.13.19	MiG-21U (*izd.* 66-400)	Hungarian AF 1319 Red'
66.13.20	MiG-21U (*izd.* 66-400)	Hungarian AF 1320 Red'
66.14.16	MiG-21U (*izd.* 66-400)	Finnish AF MK-103
66.14.17	MiG-21U (*izd.* 66-400)	Finnish AF MK-104, 'MK-106'
66.14.18	MiG-21U (*izd.* 66-400)	Hungarian AF 1418 Red
66.14.19	MiG-21U (*izd.* 66-400)	Hungarian AF 1419 Red, Indian AF U3002
66.14.20	MiG-21U (*izd.* 66-400)	Hungarian AF 1420 Red, Indian AF U671
66.15.16	MiG-21U (*izd.* 66-400)	Hungarian AF 1516 Red † 6-4-1972
66.15.17	MiG-21U (*izd.* 66-400)	Hungarian AF 1517 Red
66.17.16	MiG-21U (*izd.* 66-400)	Romanian AF 1716 Red
66.17.17	MiG-21U (*izd.* 66-400)	Romanian AF 1717 Red
66.17.19	MiG-21U (*izd.* 66-400)	Afghan AF '578 Red' (DRAAF, DGAF, IEAAF)
66.17.20	MiG-21U (*izd.* 66-400)	Hungarian AF 1720 Red, Indian AF U672
66.18.16	MiG-21U (*izd.* 66-400)	Hungarian AF 1816 Red, Indian AF U673
66.18.17	MiG-21U (*izd.* 66-400)	Hungarian AF 1817 Red, Indian AF U674
66.22.16	MiG-21U (*izd.* 66-400)	Bulgarian AF '01 White'
66.24.19	MiG-21U (*izd.* 66-600)	Czechoslovak/Slovak AF 2419 Black
66.24.20	MiG-21U (*izd.* 66-600)	East German AF 261 Black
66.25.16	MiG-21U (*izd.* 66-600)	East German AF 263 Black † 20-6-1974
66.26.17	MiG-21U (*izd.* 66-600)	East German AF 265 Black, Luftwaffe 23+90
66.26.18	MiG-21U (*izd.* 66-600)	East German AF 271 Black † 11-5-1976
66.26.19	MiG-21U (*izd.* 66-600)	East German AF 272 Black, Luftwaffe 23+91
66.26.20	MiG-21U (*izd.* 66-600)	East German AF 273 Black † 4-71974
66.27.18	MiG-21U (*izd.* 66-600)	Polish AF 2718 Red
66.27.19	MiG-21U (*izd.* 66-600)	Polish AF 2719 Red, 'Polish AF 2420 Red'
66.27.20	MiG-21U (*izd.* 66-600)	Polish AF 2720 Red
66.29.16	MiG-21U (*izd.* 66-600)	Czechoslovak/Slovak AF 2916 Black
66.32.18	MiG-21U (*izd.* 66-600)	East German AF 274 Black
66.32.19	MiG-21U (*izd.* 66-600)	East German AF 275 Black, Luftwaffe 23+92
66.32.20	MiG-21U (*izd.* 66-600)	East German AF 276 Black, Luftwaffe 23+93
66.33.15	MiG-21U (*izd.* 66-600)	East German AF 277 Black
66.33.16	MiG-21U (*izd.* 66-600)	East German AF 278 Black
66.33.17	MiG-21U (*izd.* 66-600)	Polish AF 3317 Red
66.33.18	MiG-21U (*izd.* 66-600)	Polish AF 3318 Red
66.34.16	MiG-21U (*izd.* 66-400)	Yugoslav AF 22909
66.35.16	MiG-21U (*izd.* 66-600)	Romanian AF 3516 Red
66.35.17	MiG-21U (*izd.* 66-600)	Romanian AF 3517 Red
66.38.18	MiG-21U (*izd.* 66-600)	East German AF 279 Black † 16-4-1969
66.38.19	MiG-21U (*izd.* 66-600)	East German AF 280 Black † 14-5-1970
66.38.20	MiG-21U (*izd.* 66-600)	East German AF 281 Black, Luftwaffe '23 94'
66.39.16	MiG-21U (*izd.* 66-600)	East German AF 282 Black
66.40.20	MiG-21U (*izd.* 66-600)	Hungarian AF 4020 Red
66.41.16	MiG-21U (*izd.* 66-600)	Hungarian AF 4116 Red † 8-3-1969
66.41.17	MiG-21U (*izd.* 66-600)	Hungarian AF 4117 Red, Indian AF U3003
66.44.18	MiG-21U (*izd.* 66-600)	Hungarian AF 4418 Red, N315RF
66.44.19	MiG-21U (*izd.* 66-600)	Hungarian AF 4419 Red
66.44.20	MiG-21U (*izd.* 66-600)	Hungarian AF 4420 Red, Indian AF U3004
66.45.18	MiG-21U (*izd.* 66-600)	East German AF 283 Black
66.45.19	MiG-21U (*izd.* 66-600)	East German AF 284 Black
66.45.20	MiG-21U (*izd.* 66-600)	East German AF 285 Black † 10-1-1970
66.46.16	MiG-21U (*izd.* 66-600)	East German AF 286 Black † 29-8-1972
66.46.17	MiG-21U (*izd.* 66-600)	East German AF 288 Black
66.46.20	MiG-21U (*izd.* 66-600)	East German AF 289 Black, Luftwaffe 23+95
66.47.16	MiG-21U (*izd.* 66-600)	East German AF 290 Black
66.47.18	MiG-21U (*izd.* 66-600)	East German AF 291 Black, N121TJ
66.47.19	MiG-21U (*izd.* 66-600)	East German AF 292 Black, Luftwaffe 23+96
66.47.20	MiG-21U (*izd.* 66-600)	East German AF 293 Black
66.48.16	MiG-21U (*izd.* 66-600)	East German AF 294 Black
66.48.17	MiG-21U (*izd.* 66-600)	East German AF 295 Black, Luftwaffe 23+97
66.48.18	MiG-21U (*izd.* 66-600)	East German AF 296 Black, Luftwaffe 23+98, EGAF '296 Black'
66.48.19	MiG-21U (*izd.* 66-600)	East German AF 297 Black
66.48.20	MiG-21U (*izd.* 66-600)	Czechoslovak/Slovak AF 4820 Black
66.51.17	MiG-21U (*izd.* 66-600)	Romanian AF 5117 Red
66.51.18	MiG-21U (*izd.* 66-600)	East German AF 298 Black † 1-8-1975
66.51.19	MiG-21U (*izd.* 66-600)	East German AF 299 Black † 10-12-1968
09.68.51.26	MiG-21US	Soviet AF '68 White outline' (testbed)
04.68.51.27	MiG-21US	Soviet AF (not known), Russian AF '106 Yellow'
07.68.51.32	MiG-21US 1-11-68	Czechoslovak/Czech AF 0732 Black
08.68.51.32	MiG-21US 1-11-68	Czechoslovak/Czech AF 0832 Black, N9242N † 24-8-1999
10.68.51.32	MiG-21US	Czechoslovak/Czech AF 1032 Black † 12-7-1983
01.68.51.33	MiG-21US	Czechoslovak/Czech AF 0133 Black
02.68.51.33	MiG-21US	Soviet AF '06 Red'
01.68.51.34	MiG-21US	East German AF 215 Black, '2153 Black', Luftwaffe 23+99, EGAF '215 Black'
02.68.51.34	MiG-21US	East German AF 225 Black, Luftwaffe 24+05
03.68.51.34	MiG-21US	East German AF 228 Black † 25-7-1971
04.68.51.34	MiG-21US	East German AF 230 Black, Luftwaffe 24+06
05.68.51.34	MiG-21US	East German AF 236 Black, Luftwaffe 24+07, EGAF '236 Black'
06.68.51.34	MiG-21US	Romanian AF 3406 Red
07.68.51.34	MiG-21US	Romanian AF 3407 Red
08.68.51.34	MiG-21US	Romanian AF 3408 Red
09.68.51.34	MiG-21US	Romanian AF 3409 Red
10.68.51.34	MiG-21US	Romanian AF 3410 Red
02.68.51.39	MiG-21US	East German AF 238 Black, Luftwaffe '24 08'
03.68.51.39	MiG-21US	East German AF 240 Black † 5-8-1988
04.68.51.39	MiG-21US	East German AF 242 Black, Luftwaffe 24+09
05.68.51.39	MiG-21US	East German AF 246 Black, Luftwaffe '24 10'
06.68.51.39	MiG-21US	East German AF 248 Black, Luftwaffe 24+11
08.68.51.39	MiG-21US	Romanian AF 3908 Red
10.68.51.39	MiG-21US	Romanian AF 3910 Red
07.68.57.40	MiG-21US	Polish AF 4007 Red
10.68.51.40	MiG-21US	Polish AF 4010 Red
01.68.51.41	MiG-21US	Polish AF 5141 Red
02.68.51.41	MiG-21US	Czechoslovak/Czech AF 0241 Black, OK-004, Czech AF 0241 Black, F-ZAGR
03.68.51.41	MiG-21US	Czechoslovak/Czech AF 0341 Black † 26-5-1972
04.68.51.41	MiG-21US	Czechoslovak/Slovak AF 0441 Black
05.68.51.41	MiG-21US 1-11-69	Czechoslovak/Czech AF 0541 Black
06.68.51.41	MiG-21US	Czechoslovak/Czech AF 0641 Black † 21-1-1983
07.68.51.41	MiG-21US	Romanian AF 4107 Red
09.68.51.41	MiG-21US	Romanian AF 4109 Red
07.68.51.43	MiG-21US	Bulgarian AF '05 Red'
09.68.51.43	MiG-21US	Romanian AF 4309 Red
01.68.51.44	MiG-21US	Polish AF 4401 Red
02.68.51.44	MiG-21US	Polish AF 4402 Red, N6258U, N22FR
02.68.51.45	MiG-21US	Polish AF 4502 Red, N221MG
03.68.51.45	MiG-21US	Polish AF 4503 Red

04.68.51.45	MiG-21US		Polish AF 4504 Red, N1121M
07.68.51.45	MiG-21US		East German AF 217 Black, Luftwaffe 24+01
08.68.51.45	MiG-21US		218 Black, Luftwaffe 24+02
09.68.51.45	MiG-21US		East German AF 219 Black, Luftwaffe 24+03
06.68.51.46	MiG-21US	7-4-70	Czechoslovak/Slovak AF 0646 Black
07.68.51.46	MiG-21US		Czechoslovak/Czech AF 0746 Black † 11-4-1989
08.68.51.46	MiG-21US		Polish AF 4608 Red, N9149F
09.68.51.46	MiG-21US		Polish AF 4609 Red † 20-9-1977
10.68.51.46	MiG-21US		Polish AF 4610 Red
01.68.51.47	MiG-21US		Polish AF 4701 Red
03.68.51.47	MiG-21US		Romanian AF 4703 Red
05.68.51.47	MiG-21US		Iraqi AF (not known)
06.68.51.47	MiG-21US		East German AF 220 Black † 11-8-1978
07.68.51.47	MiG-21US		East German AF 221 Black, Luftwaffe '24 04'
08.68.51.47	MiG-21US		Romanian AF 4708 Red
09.68.51.47	MiG-21US		Romanian AF 4709 Red
10.68.51.47	MiG-21US		East German AF 222 Black † 17-4-1974
01.68.51.48	MiG-21US		East German AF 250 Black, Luftwaffe 24+12
09.68.51.48	MiG-21US	17-6-70	Czechoslovak/Czech AF 0948 Black
10.68.51.48	MiG-21US	12-7-70	Czechoslovak/Czech AF 1048 Black
02.68.51.50	MiG-21US		Soviet/Russian AF '76 White'
04.68.51.50	MiG-21US		Iraqi AF (not known)
07.68.51.54	MiG-21US		Egyptian AF 5644
07.68.51.54	MiG-21US		Iraqi AF 5844
51.68.01304?	MiG-21US		Syrian AF 1304
51.68.01603?	MiG-21US		Syrian AF 1603
51.68.01702?	MiG-21US		Syrian AF 1702
51.68.06208?	MiG-21US		Sudanese AF 221, Sudanese AF 301
51.68.06209?	MiG-21US		Sudanese AF 222, Sudanese AF 302
51.68.06210?	MiG-21US		Sudanese AF 223, Sudanese AF 303
51.68.06211?	MiG-21US		Sudanese AF 224, Sudanese AF 304
09.69.51.52	MiG-21UM		Cuban AF '502 Black'
05.69.51.55	MiG-21UM		Iraqi AF (not known)
09.69.51.55	MiG-21UM		East German AF 252 Black, Luftwaffe 23+74
10.69.51.55	MiG-21UM		East German AF 253 Black, Luftwaffe 23+75
01.69.51.56	MiG-21UM		East German AF 254 Black, Luftwaffe 23+76
02.69.51.56	MiG-21UM		East German AF 256 Black, Luftwaffe 23+77
03.69.51.56	MiG-21UM		East German AF 257 Black, Luftwaffe 23+55
04.69.51.56	MiG-21UM		East German AF 259 Black, Luftwaffe 23+56
05.69.51.56	MiG-21UM		East German AF 262 Black, Luftwaffe 23+57
06.69.51.56	MiG-21UM		East German AF 264 Black, Luftwaffe 23+58
07.69.51.56	MiG-21UM		East German AF 266 Black, Luftwaffe 23+83
08.69.51.56	MiG-21UM		Polish AF 0856 Red
09.69.51.57	MiG-21UM		Polish AF 5709 Red
10.69.51.57	MiG-21UM		Polish AF 5710 Red
01.69.51.58	MiG-21UM		Hungarian AF '0158 Red'
02.69.51.58	MiG-21UM		Hungarian AF '0258 Red' † 16-10-1984
03.69.51.58	MiG-21UM		Hungarian AF '0358 Red' † 28-1-1983
06.69.51.60	MiG-21UM		Polish AF 6006 Red
08.69.51.62	MiG-21UM		Soviet/Russian AF '62 White outline'
10.69.51.62	MiG-21UM		East German AF 207 Black, Luftwaffe 23+81
01.69.51.63	MiG-21UM		East German AF 203 Black, Luftwaffe 23+84
02.69.51.63	MiG-21UM		East German AF 204 Black, Luftwaffe 23+78
03.69.51.63	MiG-21UM		East German AF 205 Black, Luftwaffe 23+79
04.69.51.63	MiG-21UM		East German AF 206 Black, Luftwaffe 23+80
01.69.51.65	MiG-21UM	12-4-72	Czechoslovak/Czech AF 0165 Black, N1165
02.69.51.65	MiG-21UM		Hungarian AF 0265 Red † 17-7-1986
03.69.51.65	MiG-21UM		East German AF 210 Black, Luftwaffe 23+53
04.69.51.65	MiG-21UM		Hungarian AF 0465 Red
05.69.51.65	MiG-21UM		Hungarian AF 0565 Red
06.69.51.65	MiG-21UM		East German AF 211 Black, Luftwaffe 23+70
07.69.51.65	MiG-21UM		Polish AF 6507 Red, N321ST
08.69.51.65	MiG-21UM		Polish AF 6508 Red † 11-5-1985
09.69.51.65	MiG-21UM		Polish AF 6509 Red, Polish AF 6509U Red
10.69.51.65	MiG-21UM		Polish AF 6510 Red
06.69.51.67	MiG-21UM		Romanian AF 6906 Red
02.69.51.68	MiG-21UM	10-8-72	Czechoslovak/Slovak AF 0268 Black
03.69.51.68	MiG-21UM	15-8-72?	Czechoslovak/Slovak AF 0368 Black
04.69.51.68	MiG-21UM	20-8-72	Czechoslovak/Czech AF 0468 Black, N7803S
05.69.51.68	MiG-21UM		East German AF 212 Black, Luftwaffe '23 59'
07.69.51.68	MiG-21UM		East German AF 213 Black, Luftwaffe 23+85*
01.69.51.69	MiG-21UM		Romanian AF 6901 Red; c/n rep. as 01695166?
04.69.51.69	MiG-21UM		Romanian AF 6904 Red
05.69.51.69	MiG-21UM		Romanian AF 6905 Red
06.69.51.69	MiG-21UM		Soviet/Russian AF '82 Red'
07.69.51.69	MiG-21UM, Lancer B*		Romanian AF 6907 Red, 6907 Black*
02.69.51.74	MiG-21UM		East German AF 167 Black, Luftwaffe 23+50
03.69.51.74	MiG-21UM		East German AF 169 Black, Luftwaffe 23+52
05.69.51.74	MiG-21UM		East German AF 168 Black, Luftwaffe 23+51*
02.69.51.75	MiG-21UM		Polish AF 7502 Red
03.69.51.75	MiG-21UM		Polish AF 7503 Red
04.69.51.75	MiG-21UM	29-5-73	Czechoslovak/Slovak AF 0475 Black
05.69.51.75	MiG-21UM		Polish AF 7505 Red, Polish AF 7505U Red, N711MG
06.69.51.75	MiG-21UM		Polish AF 7506 Red
07.69.51.75	MiG-21UM		Polish AF 7507 Red
51.69.03.021	? MiG-21UM		Romanian AF 6921 Red
51.69.03.026	? MiG-21UM		Romanian AF 6926 Red
51.69.03.031	? MiG-21UM		Hungarian AF 3031 Red
51.69.03.036	? MiG-21UM		Hungarian AF 3036 Red
51.69.03.041	? MiG-21UM		Hungarian AF 3041 Red
51.69.03.046	? MiG-21UM		Polish AF 3046 Red
51.69.05.006	? MiG-21UM		Polish AF 5006 Red
51.69.05.011	? MiG-21UM		Polish AF 5011 Red, VH-XXI/'Indian AF U2146'
51.69.05.016	? MiG-21UM		Polish AF 5016 Red
51.69.05.021	? MiG-21UM		Polish AF 5021 Red
51.69.05.026	? MiG-21UM	17-9-73?	Czechoslovak/Slovak AF 5026 Black
51.69.05.031	? MiG-21UM	31-8-73	Czechoslovak/Czech AF 5031 Black
51.69.07.046	? MiG-21UM		Romanian AF 6946 Red † 20-4-1989
51.69.07.051	? MiG-21UM		Romanian AF 6951 Red
51.69.07.056	? MiG-21UM		Romanian AF 6956 Red
51.69.07.061	? MiG-21UM		Romanian AF 6961 Red
51.69.09.001	? MiG-21UM		Somalian Air Corps 208
51.69.09.011	? MiG-21UM	1-12-73	Czechoslovak/Czech AF 9011 Black
51.69.09.016	? MiG-21UM		Czechoslovak/Czech AF 9016 Black † 14-9-1978
51.69.09.026	? MiG-21UM	17-9-73?	Soviet/Russian AF '68 White outline'
51.69.09.071	? MiG-21UM		Yugoslav/Serbian AF 16152
51.69.11.036	? MiG-21UM, MiG-21UMD		not known, Croatian AF 165
51.69.13.016	? MiG-21UM		Bulgarian AF '07 White'
51.69.13.021	? MiG-21UM		Bulgarian AF '08 White'
51.69.13.026	? MiG-21UM		Bulgarian AF '09 White'
51.69.13.031	? MiG-21UM		Bulgarian AF '10 White'
51.69.13.036	? MiG-21UM	20-2-74	Czechoslovak/Czech AF 3036 Black, N7238T
51.69.13.041	? MiG-21UM	22-2-74	Czechoslovak/Slovak AF 3041 Black
51.69.13.046	? MiG-21UM	3-1-74	Czechoslovak/Czech AF 3046 Black, N21UT
51.69.13.051	? MiG-21UM	28-2-74	Czechoslovak/Slovak AF 3051 Black, N21UT
51.69.13.056	? MiG-21UM		Polish AF 3056 Red, N317DM
51.69.13.061	? MiG-21UM		Polish AF 3061 Red † 1-10-1980
51.69.15.001	? MiG-21UM		East German AF 232 Black, Luftwaffe 23+54
51.69.15.006	? MiG-21UM		East German AF 233 Black, Luftwaffe '23 61'
51.69.15.011	? MiG-21UM		East German AF 231 Black, Luftwaffe 23+82
51.69.15.021	? MiG-21UM		East German AF 234 Black, Luftwaffe 23+73
51.69.15.071	? MiG-21UM		East German AF 226 Black, Luftwaffe 23+71
51.69.15.076	? MiG-21UM		East German AF 227 Black, Luftwaffe 23+72
51.69.15.081	? MiG-21UM		Hungarian AF 5081 Red
51.69.15.086	? MiG-21UM		Hungarian AF 5086 Red † 2-10-1979
51.69.15.091	? MiG-21UM		Hungarian AF 5091 Red
51.69.17.001	? MiG-21UM		Finnish AF MK-105
51.69.17.006	? MiG-21UM		Finnish AF MK-106
51.69.17.011	? MiG-21UM		Hungarian AF 7011 Red
51.69.21.041	? MiG-21UM		Bulgarian AF '11'
51.69.21.046	? MiG-21UM		Bulgarian AF '12'
51.69.21.051	? MiG-21UM		East German AF 228 Black, Luftwaffe 23+62
51.69.21.056	? MiG-21UM		East German AF 229 Black, Luftwaffe 23+60
51.69.21.061	? MiG-21UM		Czechoslovak/Czech AF 1061 Black † 3-8-1979

51.69.21.066	?	MiG-21UM	28-8-74	Czechoslovak/Slovak AF 5166 Black
51.69.21.071	?	MiG-21UM	20-10-74	Czechoslovak/Czech AF 1071 Black, N21EV
51.69.23.001	?	MiG-21UM	30-8-74	Czechoslovak/Slovak AF 5101 Black
51.69.31.001	?	MiG-21UM		East German AF 267 Black, Luftwaffe 23+66
51.69.31.041	?	MiG-21UM		East German AF 268 Black, Luftwaffe 23+67
51.69.31.046	?	MiG-21UM		East German AF 269 Black, Luftwaffe 23+68
51.69.31.051	?	MiG-21UM		East German AF 270 Black, Luftwaffe 23+69
51.69.31.056	?	MiG-21UM	28-2-75	Czechoslovak/Slovak AF 3156 Black
51.69.31.061	?	MiG-21UM		Soviet/Russian AF '61'
51.69.31.066	?	MiG-21UM	1-4-75	Czechoslovak/Czech AF 3166 Black
51.69.31.071	?	MiG-21UM	16-2-75	Czechoslovak/Czech AF 3171 Black, N20739
51.69.31.076	?	MiG-21UM	18-2-75	Czechoslovak/Slovak AF 3176 Black
51.69.31.081	?	MiG-21UM	22-2-75	Czechoslovak/Czech AF 3181 Black
51.69.31.086	?	MiG-21UM	1-4-75	Czechoslovak/Czech AF 3186 Black
51.69.37.041	?	MiG-21UM	4-5-75	Czechoslovak/Slovak AF 3741 Black
51.69.37.046	?	MiG-21UM	15-5-75	Czechoslovak/Czech AF 3746 Black
51.69.37.051	?	MiG-21UM	6-5-75	Czechoslovak/Czech AF 3751 Black, N3751L
51.69.37.056	?	MiG-21UM	6-5-75	Czechoslovak/Czech AF 3756 Black † 8-6-1998
51.69.39.011	?	MiG-21UM		Soviet/Russian AF '94 Yellow'
51.69.39.036	?	MiG-21UM		Bulgarian AF '13 White'
51.69.39.041	?	MiG-21UM		Bulgarian AF '14'
51.69.41.016	?	MiG-21UM, Lancer B*		Romanian AF 9501 Red, 9501 Black*
51.69.43.046	?	MiG-21UM		Soviet/Russian AF '30 Blue'
51.69.45.036	?	MiG-21UM		Bulgarian AF '37'
51.69.51.031	?	MiG-21UM, MiG-21UMD		not known, Croatian AF 166 Black
51.69.53.006?	?	MiG-21UM		Romanian AF 9506 Red
51.69.53.011?	?	MiG-21UM, Lancer B*		Romanian AF 9511 Red, 9511 Black † 17-8-1999
51.69.53.016	?	MiG-21UM, Lancer B*		Romanian AF 9516 Red, 9516 Black*
51.69.53.021	?	MiG-21UM		Romanian AF 9521 Red † 27-7-1995
51.69.53.026	?	MiG-21UM, Lancer B*		Romanian AF 9526 Red, 9526 White*, 9526 Black*
51.69.53.031	?	MiG-21UM		Romanian AF 9531 Red † 30-9-1977
51.69.53.036	?	MiG-21UM, Lancer B*		Romanian AF 9536 Red, 9536 Black*
51.69.53.041	?	MiG-21UM, Lancer B*		Romanian AF 9541 Red, 9541 Black*
51.69.53.066?	?	MiG-21UM		Romanian AF 9566 Red † 4-1992
51.69.55.086	?	MiG-21UM		Hungarian AF 086 Red
51.69.55.091	?	MiG-21UM		Hungarian AF 091 Red
51.69.55.096	?	MiG-21UM		Hungarian AF 096 Red
51.69.63.026	?	MiG-21UM		Somalian Air Corps 205
51.69.63.056	?	MiG-21UM		not known (Soviet AF), Russian AF '204 White'
51.69.69.001	?	MiG-21UM, MiG-21UMD		not known, Croatian AF 164 Black
51.69.69.066	?	MiG-21UM		Iraqi AF (not known)
51.69.72.056	?	MiG-21UM		not known (SovAF), Russian AF '210 White outline'
51.69.75.046	?	MiG-21UM		Iraqi AF (not known)
51.69.77.066	?	MiG-21UM		Bulgarian AF '34 White'
51.69.79.001	?	MiG-21UM		Bulgarian AF '38 White'
51.69.79.021	?	MiG-21UM		Bulgarian AF '35 White'
51.69.79.041	?	MiG-21UM		Bulgarian AF '15'
51.69.79.046	?	MiG-21UM		Bulgarian AF '16'
51.69.79.051	?	MiG-21UM		Bulgarian AF '17'
51.69.79.056	?	MiG-21UM		Bulgarian AF '18 White'
51.69.85.011	?	MiG-21UM		not known (Soviet AF), Russian AF '206 White'
51.69.87.051	?	MiG-21UM		not known (Soviet AF), Russian AF '300 White'
51.69.87.091	?	MiG-21UM, MiG-21UMD		not known, Croatian AF 167 Black
51.69.93.051	?	MiG-21UM		Bulgarian AF '39'
51.69.95.021	?	MiG-21UM		Bulgarian AF '19 White'
51.69.95.026	?	MiG-21UM		Bulgarian AF '20'
51.69.95.031	?	MiG-21UM		East German AF 243 Black, Luftwaffe 23+63
51.69.95.041	?	MiG-21UM		East German AF 249 Black, Luftwaffe 23+65
51.69.95.046	?	MiG-21UM		East German AF 255 Black † 9-5-1984
51.69.95.091	?	MiG-21UM		Yugoslav/Serbian AF 16158
51.69.96.036	?	MiG-21UM		East German AF 245 Black, Luftwaffe 23+64
51.69.99.054	?	MiG-21UM		not known
51.69.99.061?	?	MiG-21UM, Lancer B*		Romanian AF 061 Red; 061 Black*
51.69.99.071?	?	MiG-21UM, Lancer B*		Romanian AF 071 Red; 071 Black*
51.69.99.133	?	MiG-21UM		Bulgarian AF '36 White'
51.69.99.144	?	MiG-21UM		Yugoslav AF 16174
51.69.99.172	?	MiG-21UM, Lancer B*		Romanian AF 172 Red; 172 Black*
51.69.99.176	?	MiG-21UM, Lancer B*		Romanian AF 176 Red; 176 Black*
51.69.99.177	?	MiG-21UM, Lancer B*		Romanian AF 177 Red; 177 Black*
51.69.99.201	?	MiG-21UM		Hungarian AF 16 Red, Hungarian AF 19 Red
51.69.99.202	?	MiG-21UM		Hungarian AF 17 Red
51.69.99.203	?	MiG-21UM		Hungarian AF 18 Red
51.69.99.204	?	MiG-21UM		Hungarian AF 53 Red
51.69.99.207	?	MiG-21UM		not known, Croatian AF 162
51.69.99.209	?	MiG-21UM		Hungarian AF 35 Red (516999208?) † 6-5-1988
51.69.99.229	?	MiG-21UM		Polish AF 9229 Red, Polish Navy 9229 Red
51.69.99.231	?	MiG-21UM		Polish AF 9231 Red, Polish Navy 9231 Red
51.69.99.232	?	MiG-21UM		Polish AF 9232 Red, Polish Navy 9232 Red
51.69.99.233	?	MiG-21UM		Polish AF 9233 Red, Polish Navy 9233 Red
51.69.99.236	?	MiG-21UM		Bulgarian AF '23' † 2-6-1999
51.69.99.257	?	MiG-21UM		Bulgarian AF '24 White'
51.69.99.258	?	MiG-21UM		Bulgarian AF '21 White'
51.69.99.261	?	MiG-21UM		Bulgarian AF '25 White'
51.69.99.262	?	MiG-21UM		Bulgarian AF '22'
51.69.99.264	?	MiG-21UM		Bulgarian AF '26'
51.69.99.266	?	MiG-21UM		Bulgarian AF '27 White'
51.69.99.292	?	MiG-21UM		Polish AF 9292 Red, Polish AF 9292 Grey
51.69.99.293	?	MiG-21UM		Polish AF 9293 Red, N221UM
51.69.99.294	?	MiG-21UM		Polish AF 9294 Red, Polish Navy 9294 Red
51.69.99.296	?	MiG-21UM		Polish AF 9296 Red
51.69.99.297	?	MiG-21UM		Polish AF 9297 Red
51.69.99.298	?	MiG-21UM		Polish AF 9298 Red
51.69.99.299	?	MiG-21UM		Hungarian AF '54 Red'
51.69.99.301	?	MiG-21UM		Hungarian AF '55 Red'
51.69.99.306	?	MiG-21UM		Polish AF 9306 Red, Uganda AF (not known)
51.69.99.307	?	MiG-21UM		Polish AF 9307 Red
51.69.99.308	?	MiG-21UM		Polish AF 9308 Red, Polish AF 9308 Grey
51.69.99.309	?	MiG-21UM		Polish AF 9309 Red
51.69.99.311	?	MiG-21UM		Polish AF 9311 Red, Polish AF 9311 White outline
51.69.99.312	?	MiG-21UM		Polish AF 9312 Red
51.69.99.313	?	MiG-21UM		Polish AF 9313 Red, Polish Navy 9313 Red
51.69.99.314	?	MiG-21UM		Polish AF 9314 Red † 5-6-1981
51.69.99.316	?	MiG-21UM		Polish AF 9316 Red
51.69.99.317	?	MiG-21UM		Polish AF 9317 Red
51.69.99.321	?	MiG-21UM		Polish AF 9321 Red
51.69.99.322	?	MiG-21UM		Polish AF 9322 Red
51.69.99.323	?	MiG-21UM		Polish AF 9323 Red
51.69.99.324	?	MiG-21UM		Polish AF 9324 Red
51.69.99.326	?	MiG-21UM		Romanian AF 326 Red † 1984
51.69.99.327	?	MiG-21UM, Lancer B*		Romanian AF 327 Red, 327 Black*
51.69.99.328	?	MiG-21UM		Romanian AF 328 Red † 13-4-1993
51.69.99.329	?	MiG-21UM, Lancer B*		Romanian AF 329 Red, 329 Black*
51.69.99.332	?	MiG-21UM	26-9-80	Czechoslovak/Czech AF 9332 Black
51.69.99.333	?	MiG-21UM	15-10-80	Czechoslovak/Czech AF 9333 Black
51.69.99.339	?	MiG-21UM		Romanian AF 339 Red
51.69.99.341	?	MiG-21UM	12-2-80	Czechoslovak/Czech AF 9341 Black, Mali AF TZ-???
51.69.99.342	?	MiG-21UM	20-2-80	Czechoslovak/Czech AF 9342 Black † 17-6-1999?
51.69.99.343	?	MiG-21UM		Polish AF 9343 Red, N57GS
51.69.99.344	?	MiG-21UM		Polish AF 9344 Red
51.69.99.346	?	MiG-21UM		Polish AF 9346 Red, Polish Navy 9346 Red
51.69.99.347	?	MiG-21UM		Polish AF 9347 Red
51.69.99.348	?	MiG-21UM		Polish AF 9348 Red
51.69.99.349	?	MiG-21UM		Polish AF 9349 Red
51.69.99.351	?	MiG-21UM		Polish AF 9351 Red, Polish AF 9351 Grey
51.69.99.352	?	MiG-21UM		Polish AF 9352 Red
51.69.99.353	?	MiG-21UM		Polish AF 9353 Red
51.69.99.354	?	MiG-21UM		Polish AF 9354 Red
51.69.99.362	?	MiG-21UM		Soviet AF (not known), Russian AF '200 White'
51.69.99.375	?	MiG-21UM		Bulgarian AF '28'
51.69.99.377	?	MiG-21UM		Bulgarian AF '29 White'
51.69.99.378	?	MiG-21UM		Finnish AF MK-126 No. 1, ?
51.69.99.379	?	MiG-21UM		Finnish AF MK-143 No. 1, ?
51.69.99.399	?	MiG-21UM	16-3-82	Czechoslovak/Czech AF 9399 Black
51.69.99.408	?	MiG-21UM		Bulgarian AF '30'
51.69.99.409	?	MiG-21UM		Bulgarian AF '31'
51.69.99.410	?	MiG-21UM		Finnish AF MK-126 No. 2
51.69.99.411	?	MiG-21UM		Finnish AF MK-143 No. 2

51.69.99.413	?	MiG-21UM	Bulgarian AF '33' † 28-1-1992
51.69.99.414	?	MiG-21UM	Bulgarian AF '32'
51.69.99.436	?	MiG-21UM	Iraqi AF 21068
51.69.99.468	?	MiG-21UM	Royal Cambodian AF 7114
51.69.99.470	?	MiG-21UM	Royal Cambodian AF 7115
51.69.99.499	?	MiG-21UM	Royal Cambodian AF 7122
51.69.99.504	?	MiG-21UM	Hungarian AF 904 Red
51.69.99.505	?	MiG-21UM	Hungarian AF 905 Red
51.69.99.506	?	MiG-21UM	Hungarian AF 906 Red
51.69.99.507	?	MiG-21UM	Hungarian AF 907 Red
N01.01.03		MiG-21I (Analogue)	no code
N01.01.04		MiG-21I (Analogue)	CCCP A-144

Private MiG-21s

With its high performance, the charisma of a true jet fighter with a distinguished combat career and 'Cold War opponent' appeal, the MiG-21 was bound to attract the attentions of warbird owners and enthusiasts. As the type was phased out by its European operators, many surplus MiG-21s were offered for sale – both to air forces and to individuals and aviation enthusiast associations which could maintain and fly them. Since these aircraft would be out of place in the operators chapter, privately owned MiG-21s which are, or were, airworthy and placed on civil registers are listed here.

Australia

A single Polish Air Force MiG-21UM (5011 Red, c/n 516905011) was purchased by a private owner 'down under'. Eloquently registered VH-XXI and operated by Fighter World, the aircraft received a silver/Dayglo orange colour scheme and Indian Air Force insignia along with the fictional serial U2146 (no such serial was worn by an operational IAF MiG-21UM).

UK

Three MiG-21PFs retired by the Hungarian Air Force found their way to warbird collectors in the UK. Two of them were eventually resold to the USA; the third is no longer airworthy and is a museum piece.

Registration	Version	C/n	Comments
G-BRAM	MiG-21PF	760503	Ex 503 Red. Preserved RAF Museum, Cosford
G-BRAN	MiG-21PF	760506	Ex 506 Red. Sold as N316DM
G-BRAO	MiG-21PF	761603	Ex 1603 Red. Sold to the USA as N621DM

USA

The USA boasts by far the largest collection of privately owned MiG-21s gathered from far and wide. Such aircraft are operated in the Experimental category with a limited certificate of airworthiness. Some of the owners are well-known warbird collectors who operate other MiGs into the bargain. Known civil MiG-21s operated in the USA are listed below.

Registration	Version	C/n	Comments
N21EV	MiG-21UM	516921071	Ex Czech AF 1071 Black. Owned by Elaine Vickery, Galveston, TX
N21MG	MiG-21PF	761603	Ex N621DM. Owned by EAA Aviation Foundation Inc., Oshkosh, WI
N21PF	MiG-21PF	761811	Ex Polish AF 1811 Red. Owned by IXOR, Santa Maria, CA
N21UT	MiG-21UM	516913046	Ex Czech AF 3046 Black. Owned by Experimental Rocket Racing Association LLC, Bothell, WA. Also reported as ex Czech AF 3051 Black (c/n 516913051)
N22FR	MiG-21US	02685144	Ex Polish AF 4402 Red; ex N6285U?. Owned by Luke D. Brader, Friendswood, TX
N57GS	MiG-21UM	516999343	Ex Polish AF 9343 Red. Owned by Kim E. Vinson Successor Trustee, Klamath Falls, OR
N63SG	MiG-21	0241 (?)	Exact version and ex identity unknown. Owned by MiGs of Delaware LLC, Wilmington, DE
N121MG	MiG-21PF	761309	Ex Czech AF 1309 Black, bought 1993. Owned by Airmarc Inc., Wheaton, IL
N121TJ	MiG-21U (izd. 66-600)	664718	Ex EGAF 291 Black. Owned by Thomas M. Jackson, California City, CA
N213DM	MiG-21PF	761603	Ex N621DM. Owned by Warplanes Inc., South Burlington, VT
N221GL	MiG-21PFM	94N7809	Ex Polish AF 7809 Red. Owned by Gary Dean Lewis, Baytown, TX
N221MG	MiG-21US	02685145	Ex Polish AF 4502 Red. Owned by David B. Trant, Baytown, TX. Also reported as ex 4504 Red (c/n 04685145)
N221UM	MiG-21UM	516999293	Ex Polish AF 9293 Red, bought 2003. Owned by John B. Fulton II, Menlo Park, CA
N221YA	MiG-21F-13	261114	Ex Czech Air Force 1114 Black, bought 1997 ex Canada. Owned by Yak America Corp., St. Louis, MO
N315RF	MiG-21U (izd. 66-600)	664418	Ex Polish AF 4418 Red. Owned by San Diego Flight Museum, Coronado, CA
N316DM	MiG-21PF	760506	Ex G-BRAN. Owned by Airmarc Inc., Wheaton, IL
N317DM	MiG-21UM	516913056	Ex Polish AF 3056 Red, bought 1992. Owned by Air USA Inc., Quincy, IL
N321LS	MiG-21	...905	Exact version and ex identity unknown. Owned by Larry Strimple, Perrysville, OH
N321ST	MiG-21UM	07695165	Ex Polish AF 6507 Red. Owned by Donald A. Swan Jr., Scottsdale, AZ
N711MG	MiG-21UM	05695175	Ex Polish AF 7505U Red. Owned by Paul van den Heuvel, Lake in the Hills, IL
N1011E	MiG-21F-13	161011	Ex Czech AF 1011 Black. Owned by Merle Maine Enterprise Inc., Ontario, OR
N1101E	MiG-21F-13	161101	Ex Czech AF 1101 Black. Owned by Merle Maine Enterprise Inc., Ontario, OR
N1121M	MiG-21US	04685145	Ex Polish AF 4504 Red, bought 1992. Owned by Cavanaugh Flight Museum Inc., Addison, TX
N3751L	MiG-21UM	516937051	Ex Polish AF 3751 Red. Owned by Viola G. Donkel, Portland, OR
N4318W	MiG-21	5068 (?)	Exact version and ex identity unknown. Owned by Onesource Financial Holdings LLC, Newark, DE
N5179Y	MiG-21PF	761304	Ex Czech AF 1304 Black. Owned by Onesource Financial Holdings LLC, Newark, DE
N621DM	MiG-21PF	761603	Ex G-BRAO. Sold as N21MG
N6285D	MiG-21F-13?	261108?	Ex Czech Air Force 1108 Black, bought 1996; also reported as MiG-21PF c/n 761108 (ex EGAF 890 Red) bought 2001! Owned by Kenneth C. Chase Jr., Rochester, MN
N6285L	MiG-21F-13?	261109?	Ex Czech Air Force 1109 Black, bought 1996; also reported as MiG-21PF c/n 761109 (ex EGAF 893 Red) bought 2001! Based Portland, OR
N6285U	MiG-21US?	02685144?	Ex Polish AF 4402 Red, owned by Marlo Treit, Aurora, OR; sold as N22FR? Also reported as MiG-21PFM c/n 964402 (ex Czech AF 4402 Black) bought 1994!
N7238T	MiG-21UM	516913036	Ex Czech Air Force 3036 Black. Owned by MiG21 Corp., Atwater, CA
N7803S	MiG-21UM	04695168	Ex Czech Air Force 0468 Black. Owned by Vulcan Warbirds Inc., Seattle, WA
N7803Z	MiG-21R	94R01904	Ex Czech Air Force 1904 Black. Owned by Vulcan Warbirds Inc., Seattle, WA
N9149F	MiG-21US	08685146	Ex Polish AF 4608 Red
N9242N	MiG-21US	08685132	Ex Czech Air Force 0832 Black. Owned by Air USA Inc., Baker, MT
N1165	MiG-21UM	01695165	Ex Czech Air Force 0165 Black. Owned by MiGs of Delaware LLC, Wilmington, DE
N7708	MiG-21MF	967708	Ex Czech Air Force 7708 Black. Owned by South Florida Antiquities Defense Museum Inc., Fort Myers, FL
N9307	MiG-21MF	96004307	Ex Czech AF 4307 Black. Owned by Oscar W. Vickery, Galveston, TX
N20739	MiG-21UM	516931071	Ex Czech AF 3171 Black. Owned by MiGs of Delaware LLC, Wilmington, DE
N30421	MiG-21R	94R021049	Ex Czech AF 2149 Black. Sale reported, Chino, CA
N80634	MiG-21R	94R020066	Ex Czech AF 2066 Black. Owned by George D. Hickman, Gordo, AL
N80639	MiG-21R	94R021033	Ex Czech AF 2133 Black. Owned by Stephen M. Rosenberg, Novato, CA

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